Asia Pacific Network Information Centre
APNIC

# Welcome!

## APNIC Members Training Course

*Internet Resource Management Essentials*

31 August 2004, Nadi, Fiji

APNIC -18 Open Policy Meeting

# Introduction

- Presenters
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<training@apnic.net>

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# Assumptions & Objectives

## Assumptions

- Are current or prospective APNIC member
- Have not submitted many requests
- Are not familiar / up-to-date with policies & procedures

## Objectives

- Teach how to request resources from APNIC
- Keep membership up-to-date with latest policies
- Liaise with members
  - Faces behind the e-mails

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# Schedule

- Intro to APNIC
- Policy development
- Policies
- Whois DB – Part I

TEA BREAK
(10:30 – 11:00)

- Whois DB – Part II
- Requesting IP
- Reverse DNS
- ASN
- IPv6 Overview

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# Introduction to APNIC

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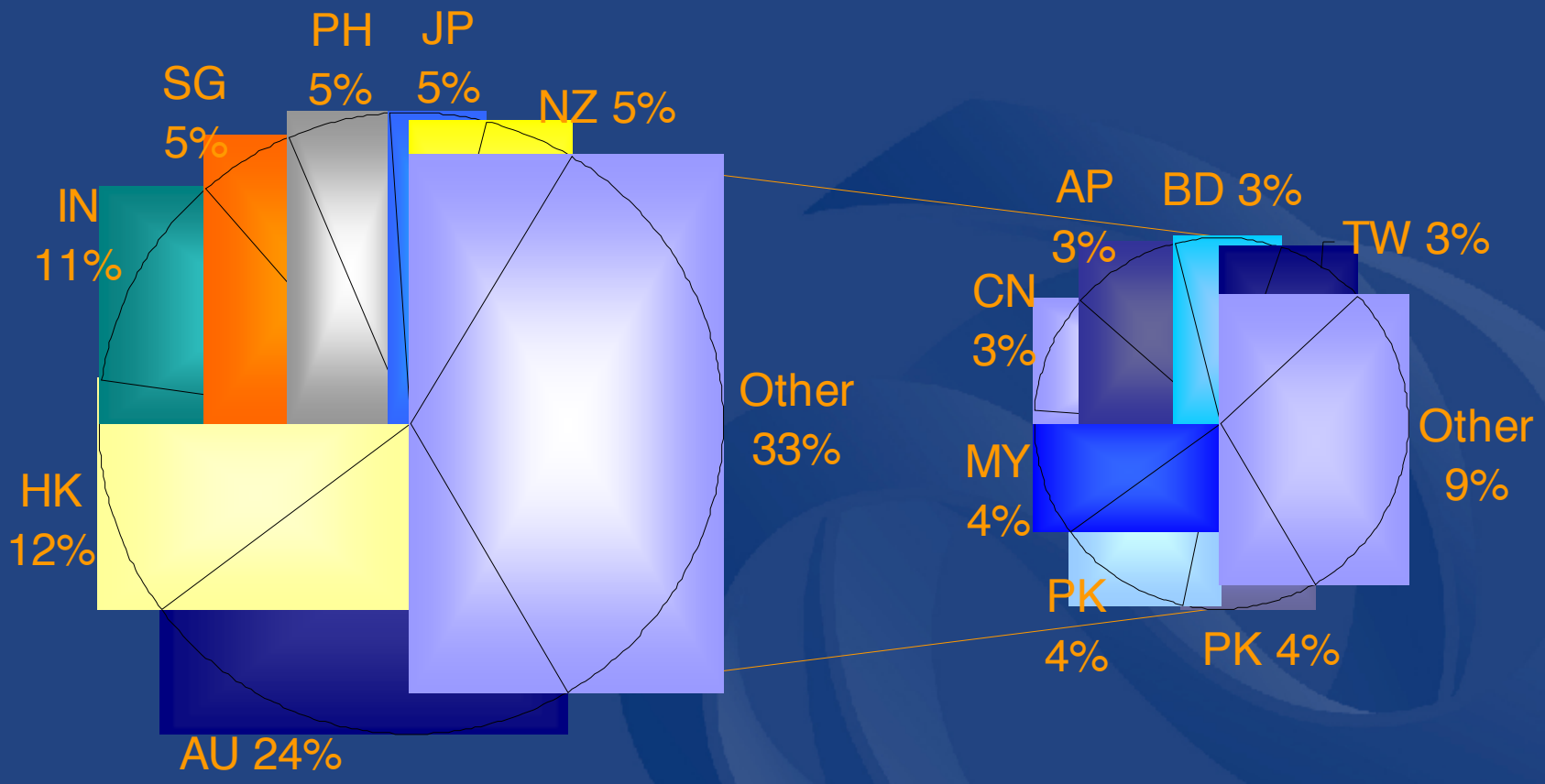
# What is APNIC?

- RIR for the Asia Pacific
  - Regional Internet Registry
  - Regional authority for Internet Resource distribution
  - IPv4 & IPv6 addresses, ASNs, reverse dns delegation
- Industry self-regulatory body
  - Non-profit, neutral and independent

- Open membership-based structure

# APNIC membership



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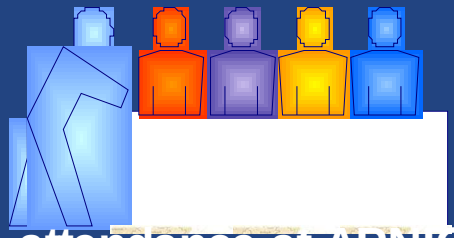
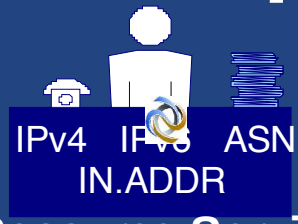
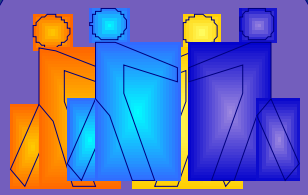
# Benefits of APNIC membership



Free attendance at APNIC Members Meetings

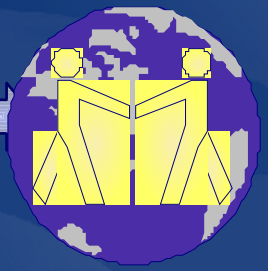



Resource Services & Registration Services



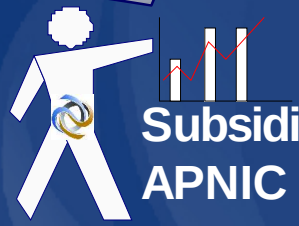
APNIC Membership

Voting rights at APNIC Meetings



Participation in the APNIC Community

Influence in APNIC Activities



Subsidised access to APNIC Training

- *NOT: Automatic or easier resource allocation*

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# APNIC is not…

- Not a network operator
  - Does not provide networking services
    - Works closely with APRICOT forum
- Not a standards body
  - Does not develop technical standards
    - Works within IETF in relevant areas (IPv6 etc)
- Not a domain name registry or registrar
    - Will refer queries to relevant parties

# APNIC region

# Checkpoint

- *What is APNIC's primary role?*

To distribute and manage Internet resources (IP addresses & AS numbers) in a fair and responsible manner

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# Questions ?



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# Policy Development in the Asia Pacific

The APNIC Community

&

the Policy Development Process

# What is the APNIC community?

- **Open** forum in the Asia Pacific
  - Open to any interested parties
- Voluntary participation
- Decisions made by consensus
- Public meetings
- Mailing lists
  - http://www.apnic.net/community/lists/index.html
  - web archived

- *A voice in regional Internet operations through participation in APNIC activities*

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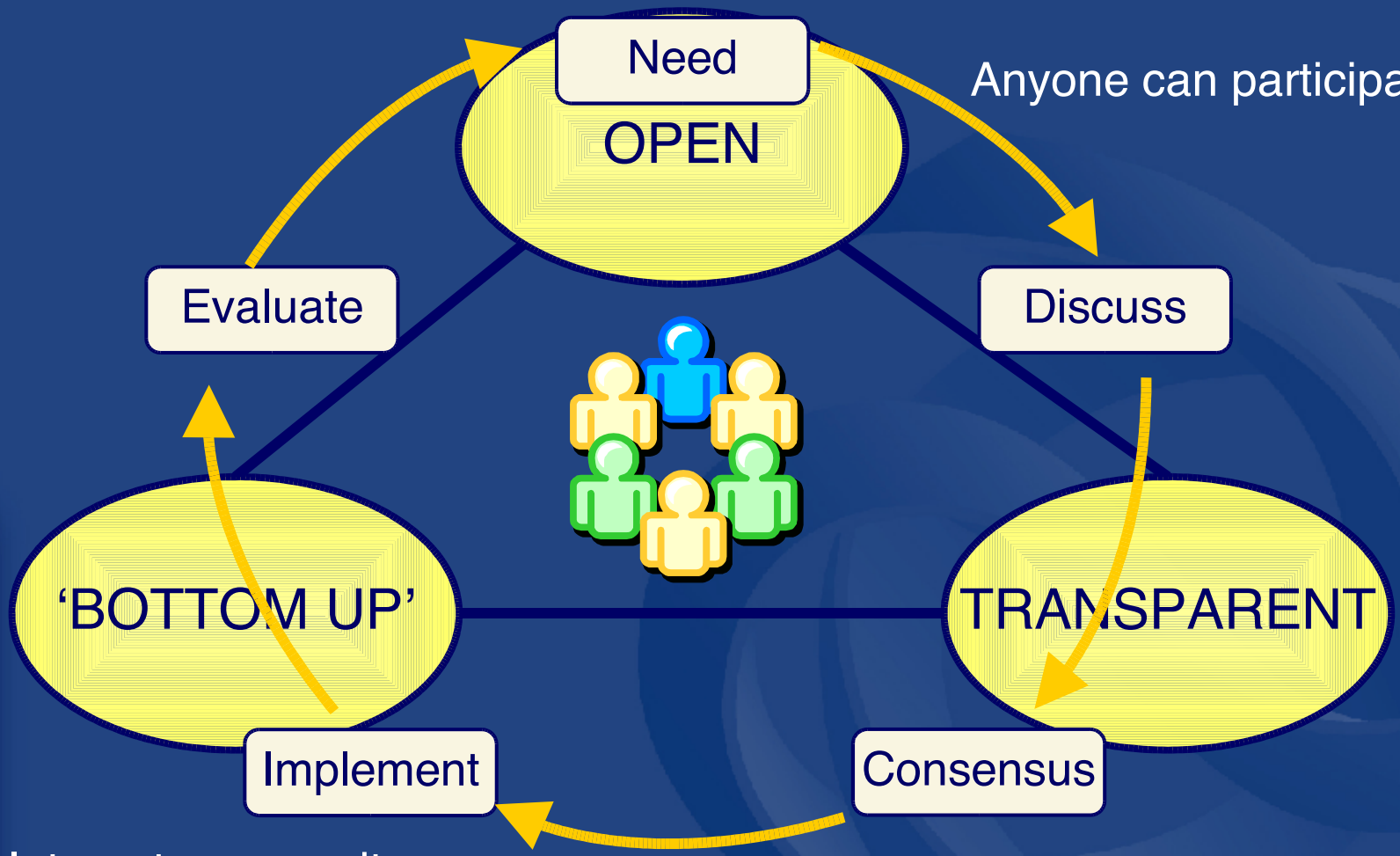
# Policy development cycle

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# The policy development process


More information about policy development can be found at:

http://www.apnic.net/docs/policy/dev

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# Checkpoint

- *Who can propose Internet resource policy?*

Anyone can propose policy change!

APNIC members, members of the community, APNIC staff or anyone interested in Internet policy!

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# Questions ?



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# Internet Registry Allocation and Assignment

Policies

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# Allocation and Assignment

## Allocation

*"A block of address space held by an IR (or downstream ISP) for subsequent allocation or assignment"*

- Not yet used to address any networks

## Assignment

*"A block of address space used to address an operational network"*

- May be provided to LIR customers, or used for an LIR's infrastructure ('self-assignment')

# Allocation and Assignment

APNIC
*Allocates*
to APNIC Member

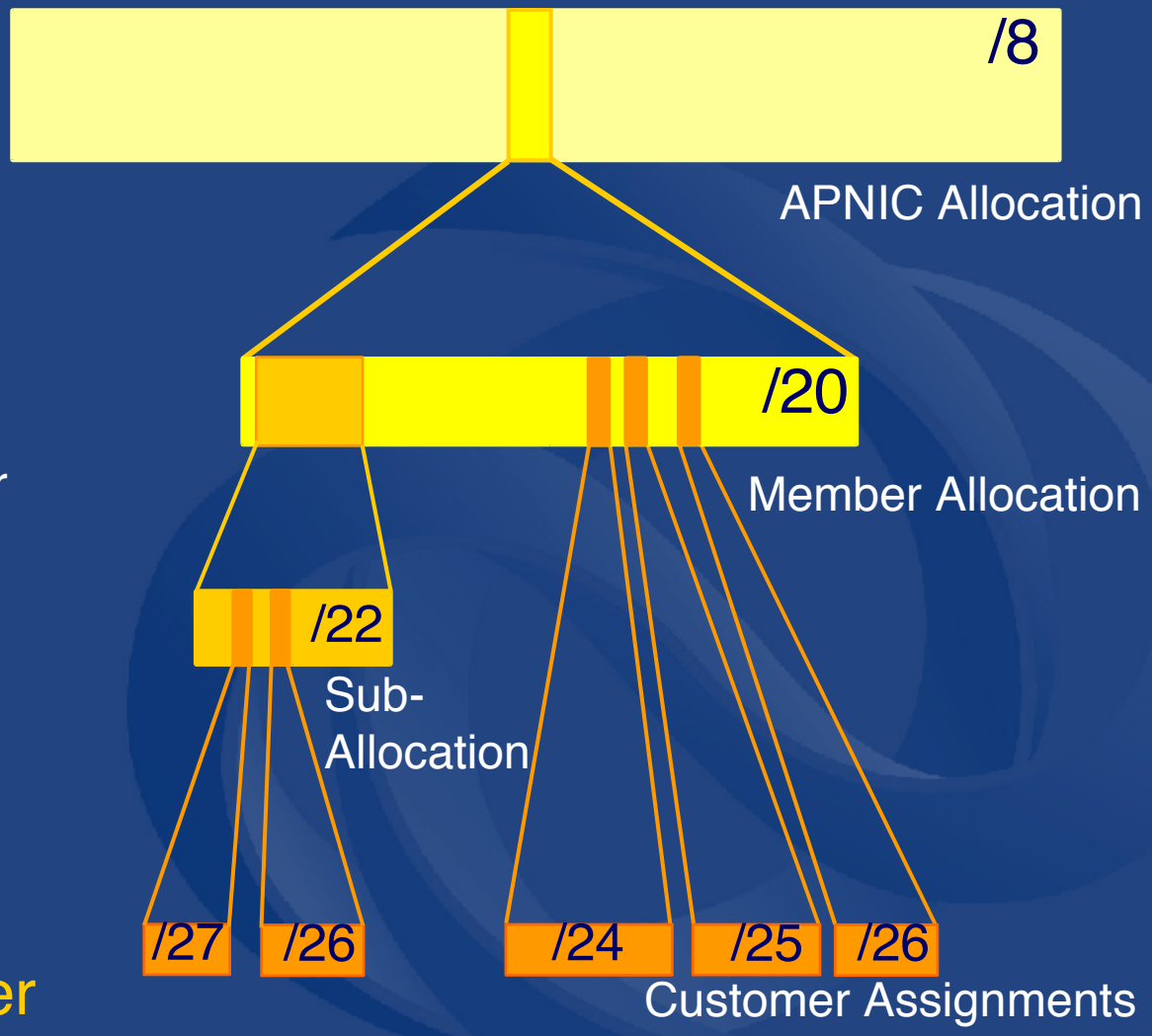
APNIC Member

*Allocates*
to downstream

*Assigns*
to end-user

Downstream
*Assigns*
to end-user

Customer / End User

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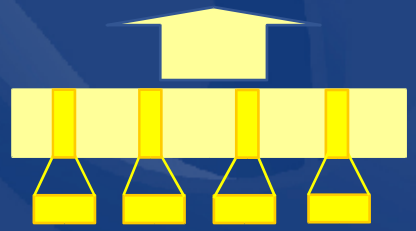
# Portable & non-portable

## Portable Assignments

- Customer addresses independent from ISP
  - Keeps addresses when changing ISP
- Bad for size of routing tables
- Bad for QoS: routes may be filtered, flap-dampened

## Non-portable Assignments

- Customer uses ISP's address space
  - Must renumber if changing ISP
- Only way to effectively scale the Internet

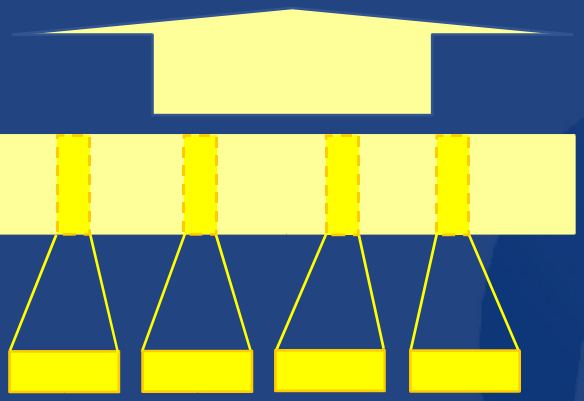


# Aggregation and "portability"

## Aggregation

BGP Announcement (1)

ISP Allocation

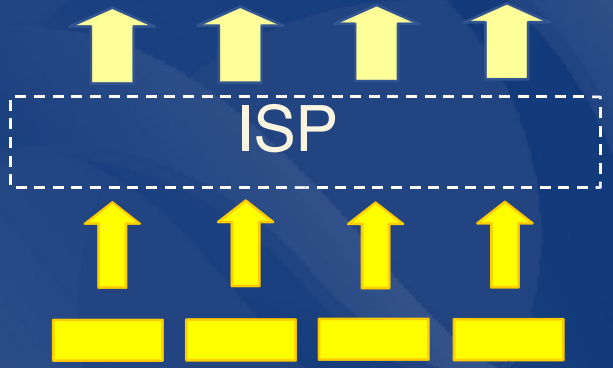


Customer Assignments

(Non-portable Assignments)

## No Aggregation

BGP Announcements (4)




Customer Assignments

(Portable Assignments)

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# Address management objectives

## Conservation

- Efficient use of resources
- Based on demonstrated need

## Aggregation

- Limit routing table growth
- Support provider-based routing

## Registration

- Ensure uniqueness
- Facilitate trouble shooting

Uniqueness, fairness and consistency

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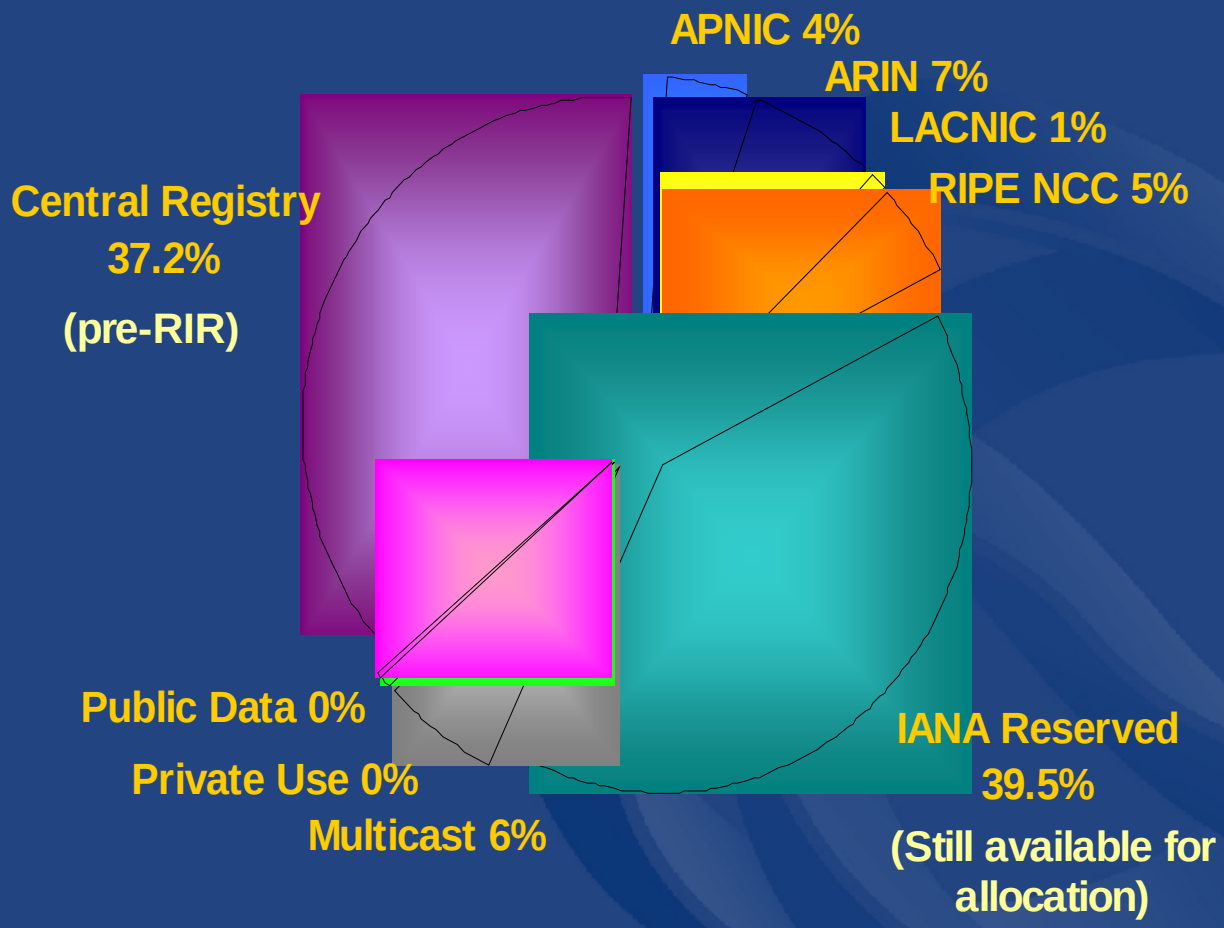
# Why do we need policies?
## - Global IPv4 Delegations

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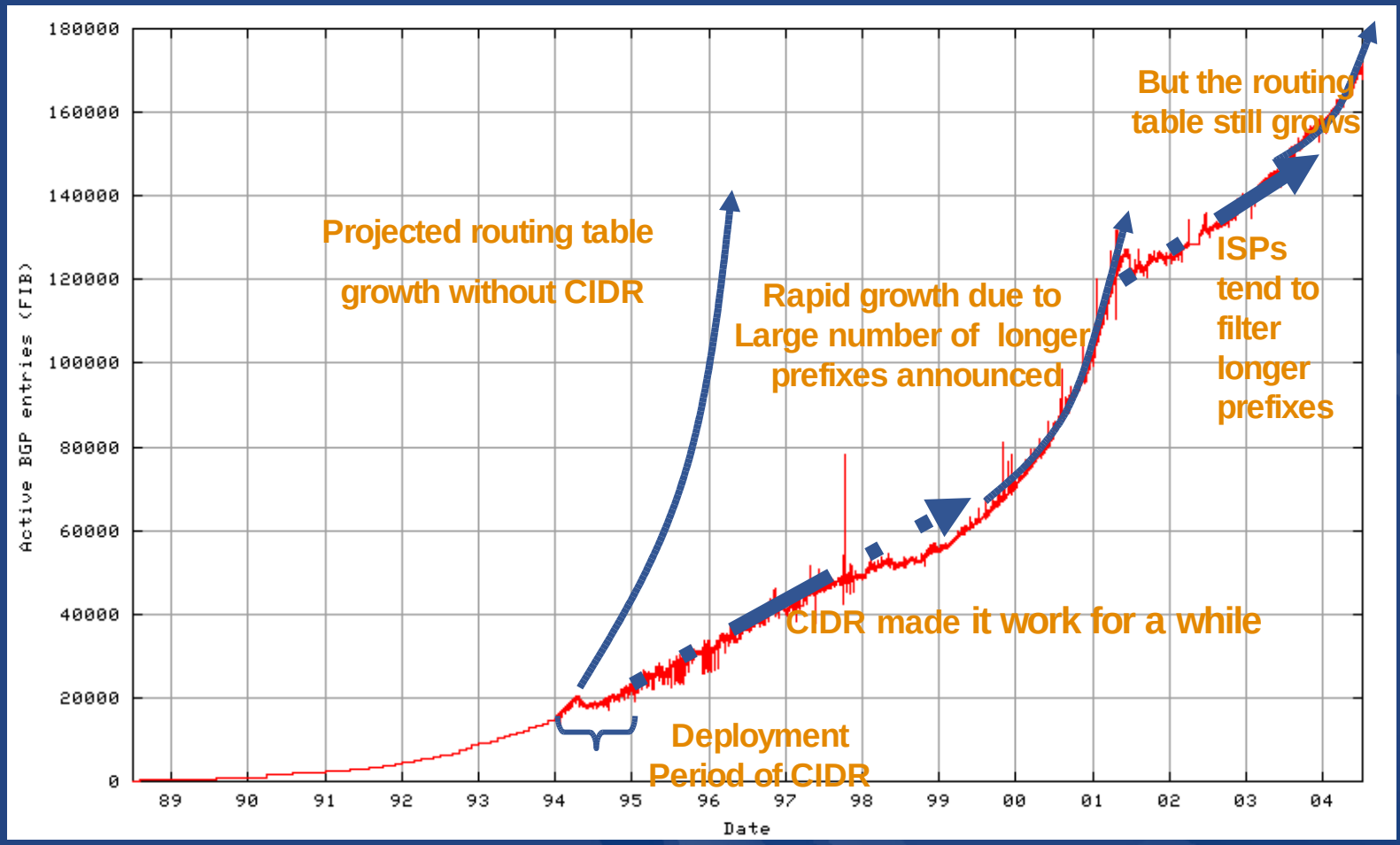
# Growth of global routing table




http://bgp.potaroo.net/as1221/bgp-active.html

last updated 07 July 2004

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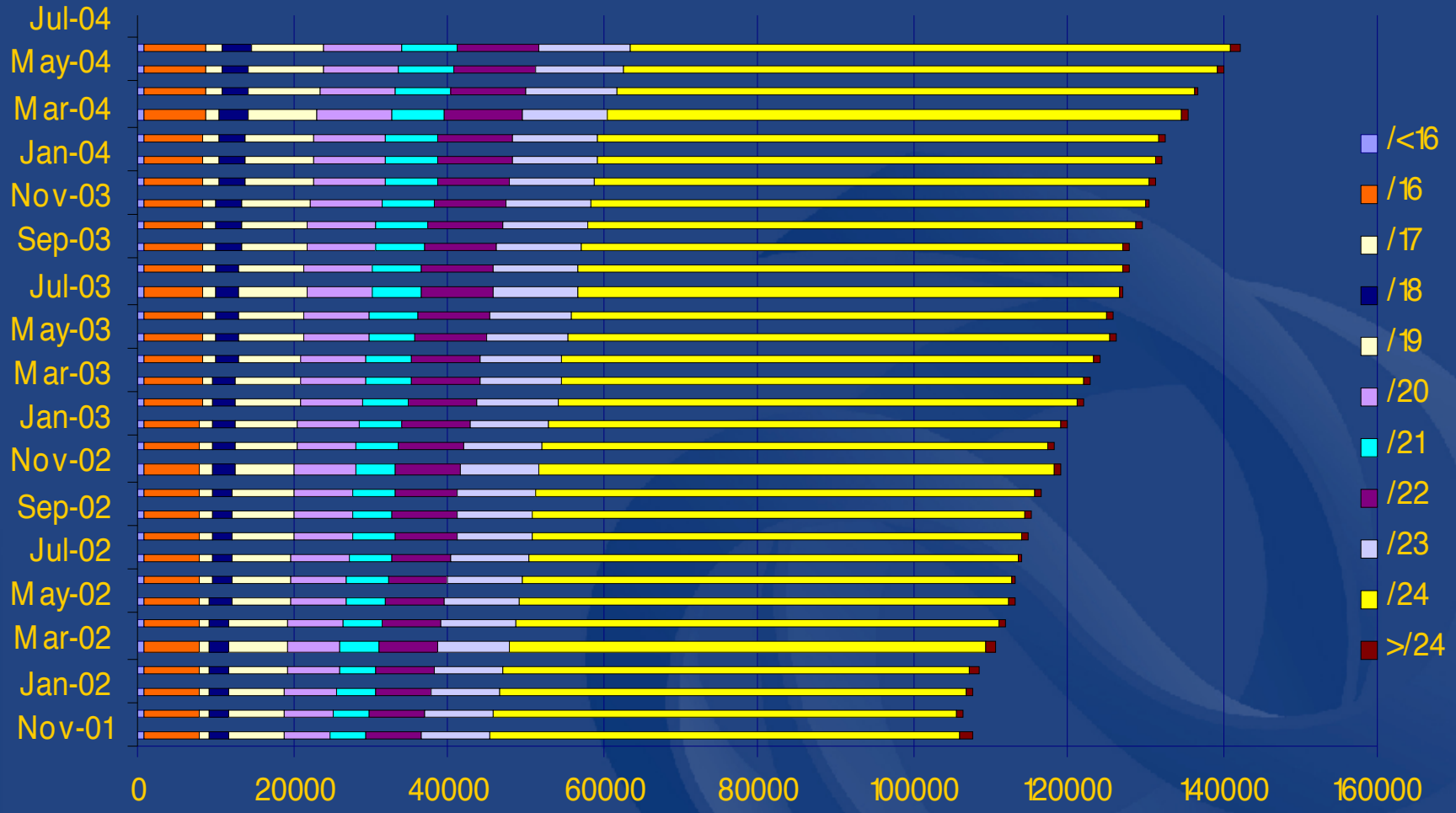
# Routing table prefix distribution




Last updated Jul 2004

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# APNIC policy environment

*"IP addresses not freehold property"*

- Assignments & allocations on license basis
  - Addresses *cannot* be bought or sold
  - Internet resources are public resources
  - 'Ownership' is contrary to management goals

*"Confidentiality & security"*

- APNIC to observe and protect trust relationship
  - Non-disclosure agreement signed by staff

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# APNIC allocation policies

- Aggregation of allocation
  - Provider responsible for aggregation
  - Customer assignments /sub-allocations must be non-portable
- Allocations based on demonstrated need
  - Detailed documentation required
    - All address space held to be declared
  - Address space to be obtained from one source
    - routing considerations may apply
  - Stockpiling not permitted

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# APNIC allocation policies

- Transfer of address space
  - Not automatically recognised
    - Return unused address space to appropriate IR
- Effects of mergers, acquisitions & take-overs
  - Will require contact with IR (APNIC)
    - contact details may change
    - new agreement may be required
  - May require re-examination of allocations
    - requirement depends on new network structure

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# Initial IPv4 allocation

New policy

new!

Initial (portable) allocation size and criteria have been lowered:

- Allocation size: /21 (2048 addresses)*.
- The allocation can be used for further assignments to customers or your own infrastructure.

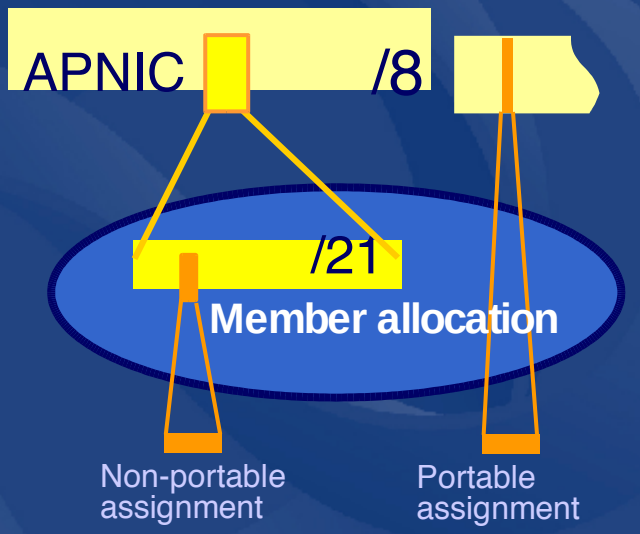
## Criteria

1a. Have used a /23 from upstream provider
- Demonstrated efficient address usage

OR

1b. Show immediate need for /23
- Can include customer projections & infrastructure equipment

2. Detailed plan for use of /22 within 1 year
3. Renumber to new space within 1 year




*New policy will be implemented Aug 2004

# Portable assignments

- Small multihoming assignment policy
  - *For (small) organisations who require a portable assignment for multi-homing purposes*

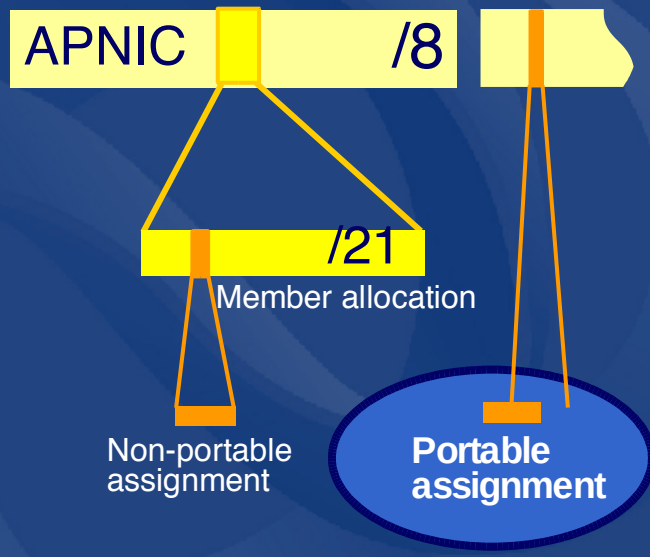
Criteria

1a. Applicants currently multihomed

OR

1b. Demonstrate a plan to multihome within 1 month

2. Agree to renumber out of previously assigned space
   - *Demonstrate need to use 25% of requested space immediately and 50% within 1 year*

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# Portable assignments for IXPs

Criteria

- 3 or more peers
- Demonstrate “open peering policy”

- APNIC has a reserved block of space from which to make IXP assignments

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# Portable critical infrastructure assignments

- What is Critical Internet Infrastructure?
  - Domain registry infrastructure
    - Root DNS operators
    - gTLD operators
    - ccTLD operators
  - Address Registry Infrastructure
    - RIRs & NIRs
    - IANA
- Why a specific policy ?
  - Protect stability of core Internet function
- Assignment sizes:
  - IPv4: /24
  - IPv6: /32

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# Questions ?



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# Checkpoint

- *Why are portable assignments discouraged?*

Portable assignments cannot be aggregated and need therefore to be announced separately, adding to the growing size of the Global Routing Table

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# The APNIC Database

## Introduction and Usage

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# What is the APNIC database?

- Public network management database
  - Operated by IRs
- Tracks network resources
  - IP addresses, ASNs, Reverse Domains, Routing policies
- Records administrative information
  - Contact information (persons/roles)
  - Authorisation

# Object types

| OBJECT | | PURPOSE |
|---|---|---|
| person |  | contact persons |
| role |  | contact groups/roles |
| inetnum |   | IPv4 addresses |
| inet6num |   | IPv6 addresses |
| aut-num |   | Autonomous System number |
| domain |   | reverse domains |
| route |  | prefixes being announced |
| mntner |  | (maintainer) data protection |

http://www.apnic.net/db/

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# Object templates

To obtain template structure*, use :
whois -t <object type>

```
% whois -h whois.apnic.net -t person
```

```
person:   [mandatory]  [single]     [primary/look-up key]
address:  [mandatory]  [multiple]   [ ]
country:  [mandatory]  [single]     [ ]
phone:    [mandatory]  [multiple]   [ ]
fax-no:   [optional]   [multiple]   [ ]
e-mail:   [mandatory]  [multiple]   [look-up key]
nic-hdl:  [mandatory]  [single]     [primary/look-up key]
remarks:  [optional]   [multiple]   [ ]
notify:   [optional]   [multiple]   [inverse key]
mnt-by:   [mandatory]  [multiple]   [inverse key]
changed:  [mandatory]  [multiple]   [ ]
source:   [mandatory]  [single]     [ ]
```

*Recognised by the RIPE whois client/server

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# Person object example

– Person objects contain contact information

| Attributes | Values |
|---|---|
| **person:** | Ky Xander |
| address: | ExampleNet Service Provider |
| address: | 2 Pandora St Boxville |
| address: | Wallis and Futuna Islands |
| country: | WF |
| phone: | +680-368-0844 |
| fax-no: | +680-367-1797 |
| e-mail: | kxander@example.com |
| nic-hdl: | KX17-AP |
| mnt-by: | MAINT-WF-EX |
| changed: | kxander@example.com 20020731 |
| source: | APNIC |

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# What is a nic-hdl?

- Unique identifier for a person
- Represents a person object
  - Referenced in objects for contact details
    - ( IP , IPv6 , AS , DNS ...)
  - format: <XXXX-AP>
    - Eg: KX17-AP

```
person:   Ky Xander
address:      ExampleNet Service Provider
address:      2 Pandora St Boxville
address:      Wallis and Futuna Islands
country:      WF
phone:        +680-368-0844
fax-no:       +680-367-1797
e-mail:       kxander@example.com
nic-hdl:  KX17-AP
mnt-by:       MAINT-WF-EX
changed:      kxander@example.com 20020731
source:       APNIC
```

# Inetnum object example

IP

– Contain IP address allocations / assignments

| | |
|---|---|
| **inetnum:** | 202.51.64.0 - 202.51.95.255 |
| netname: | CCNEP-NP-AP |
| descr: | Communication & Communicate Nepal Ltd |
| descr: | VSAT Service Provider, Kathmandu |
| country: | NP |
| admin-c: | AS75-AP |
| tech-c: | AS75-AP |
| mnt-by: | APNIC-HM |
| mnt-lower: | MAINT-NP-ARUN |
| remarks: | -+-+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+- |
| remarks: | This object can only be updated by APNIC |
| remarks: | hostmasters.To update this object, please contact |
| remarks: | APNIC hostmasters and include your organisation's |
| remarks: | account name in the subject line. |
| remarks: | -+-+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+- |
| changed: | hostmaster@apnic.net 20010205 |
| status: | ALLOCATED PORTABLE |
| source: | APNIC |

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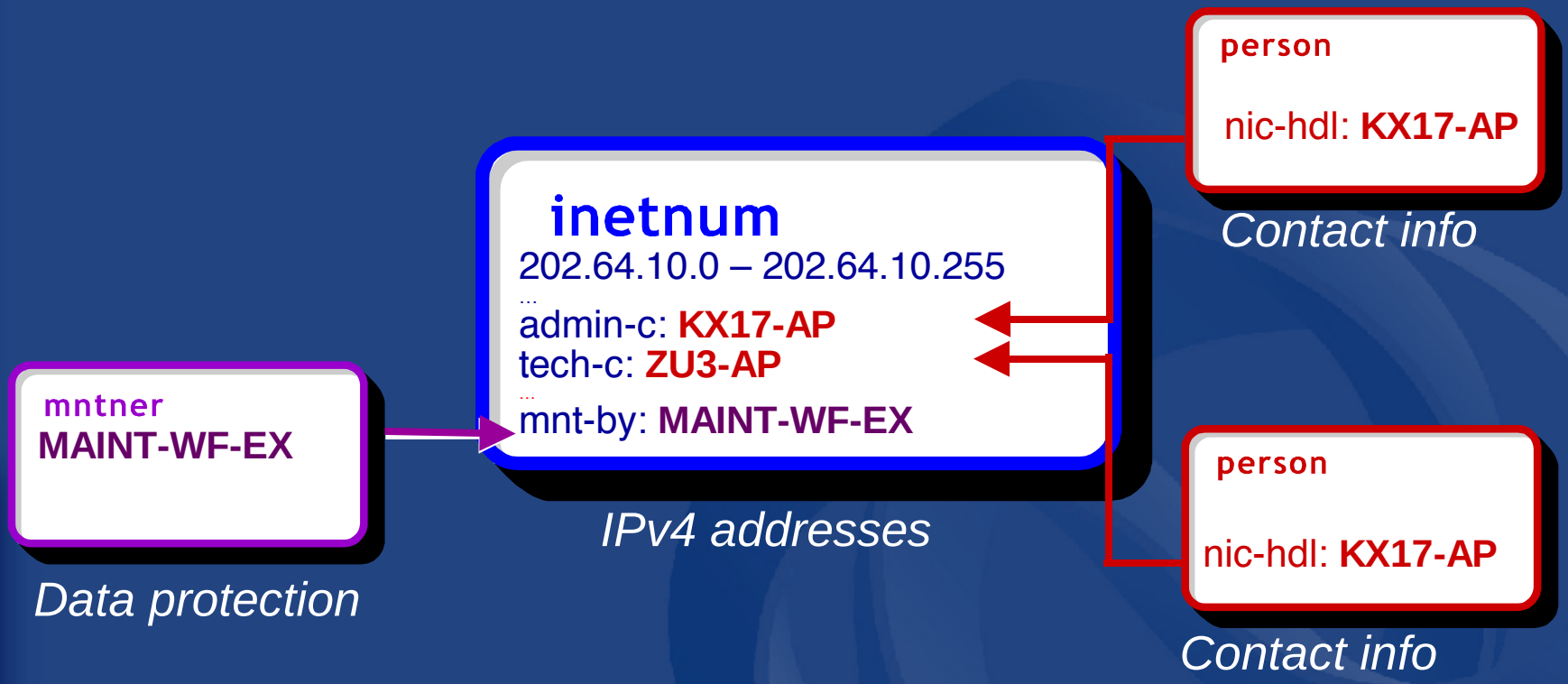
# Inter-related objects

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# Database query - clients

- Standard whois client
  - Included with many Unix distributions
  - RIPE extended whois client
    - http://ftp.apnic.net/apnic/dbase/tools/ripe-dbase-client.tar.gz
- Query via the APNIC website
  - http://www.apnic.net/apnic-bin/whois2.pl
- Query clients - MS-Windows etc
  - Many available

# Basic database queries

- Unix
  - whois –h whois.apnic.net <lookup key>
- Web interface
  - http://www.apnic.net/apnic-bin/whois2.pl
- Look-up keys
  - usually the object name
  - Check template for look-up keys

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# Database query - inetnum

IP

```
% whois 203.127.128.0 - 203.127.159.255
% whois 203.127.128.0/19
% whois SINGNET-SG
```

```
inetnum:    203.127.128.0 - 203.127.159.255
netname:    SINGNET-SG
descr:      Singapore Telecommunications Ltd
descr:      31, Exeter Road, #02-00, Podium Block
descr:      Comcentre, 0923
country:    SG
admin-c:    CWL3-AP
tech-c:     CWL3-AP
mnt-by:     APNIC-HM
changed:    hostmaster@apnic.net 19990803
source:     APNIC
```

- Note
  - Incomplete addresses padded with ".0"
  - Address without prefix interpreted as "/32"

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# Database query - web

http://www.apnic.net/apnic-bin/whois2.pl

Query the APNIC Whois Database - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://www.apnic.net/apnic-bin/whois2.pl Go

Query the APNIC Whois Database

Need help?

1.Type in search key

Search for OA3-AP Search

3. 'Search Whois'

IP address lookups

-l 1st level less specific

-L All less specific

-m 1st level more specific

-M All more specific

-x Exact match only

-d Associated reverse domain

Miscellaneous queries

-i Inverse attributes None

-T Object types All as-block as-set

Query hints

- Include "AS" in front of an AS number. Example: AS4808
- Include "-t" (template only) or "-v" (template and description) in front of an object name to view the template Example: -t inetnum

Further informa

- APNIC Whois
- APNIC Whois

2.Search options (flags)

Internet

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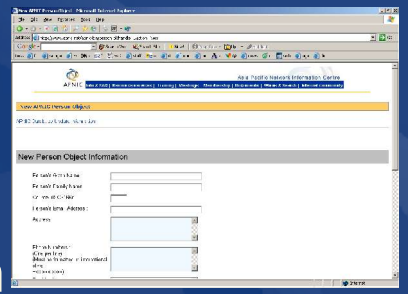
# Creating a person object

Whois Database Guide:

http://www.apnic.net/services/whois_guide.html

4. Fill out person object form on web
   - Name, e-mail, phone, address etc
   - Tick ‘MNT-NEW’ for temporary protection




2. Completed template is sent to you
3. Forward template to <auto-dbm@apnic.net>
4. Person object created and nic-hdl is generated

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# Customer privacy

To be implemented Sep 2004

- To protect privacy if customer records
  - New attribute – “public” be added to:
    - inetnum and inet6num objects
    - “public”: YES = public data
    - “public”: No = private data
      - (not to be revealed by whois queries)
    - Default (missing attribute) = private data
  - Customer assignments registration is still mandatory

# Database mailboxes

- Automatic request processing


<auto-dbm@apnic.net>

  - Automatic “robot” for all db updates
  - Email template for create/update/delete

- Database service support


<helpdesk@apnic.net>

  - E-mails answered by APNIC staff
  - 1 day response time

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# Checkpoint

- *How can I query the APNIC whois Database?*

By using the web interface:

http://www.apnic.net/apnic-bin/whois.pl

or Unix command line:

whois –h whois.apnic.net <lookup>

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# Questions ?



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# The APNIC Database

## Protection and Updating

# Database protection - maintainer object

```
mntner:       MAINT-WF-EX
descr:        Maintainer for ExampleNet Service Provider
country:      WF
admin-c:      ZU3-AP
tech-c:       KX17-AP
upd-to:       kxander@example.com
mnt-nfy:      kxander@example.com
auth:         CRYPT-PW apHJ9zF3o
mnt-by:       MAINT-WF-EX
referral-by:  MAINT-APNIC-AP
changed:      kxander@example.com 20020731
source:       APNIC
```

- protects other objects in the APNIC database

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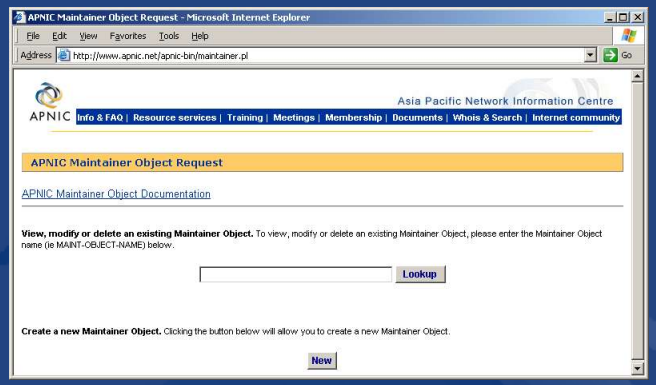
# Creating a maintainer object




1. Fill out webform
   - Provide:
     - Admin-c & tech-c
     - password
     - email address etc
2. Completed form will be sent to you
3. Forward request to maint-request@apnic.net
4. Maintainer will be created *manually*
   - Manual verification by APNIC Hostmasters
5. Update your person object with mntner

http://www.apnic.net/services/whois_guide.html

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# Database protection

- Authorisation
  - "mnt-by" references a mntner object
    - Can be found in all database objects
    - "mnt-by" should be used with every object!
- Authentication
  - Updates to an object must pass authentication rule specified by its maintainer object

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# Authorisation mechanism

| | |
|---|---|
| inetnum: | 202.137.181.0 – 202.137.185.255 |
| netname: | EXAMPLENET-WF |
| descr: | ExampleNet Service Provider |
| ……. | |
| **mnt-by:** | **MAINT-WF-EX** |

IP

| | |
|---|---|
| **mntner:** | **MAINT-WF-EX** |
| descr: | Maintainer for ExampleNet Service Provider |
| country: | WF |
| admin-c: | ZU3-AP |
| tech-c: | KX17-AP |
| upd-to: | kxander@example.com |
| mnt-nfy: | kxander@example.com |
| auth: | CRYPT-PW apHJ9zF3o |
| mnt-by: | MAINT-WF-EX |
| changed: | kxander@example.com 20020731 |
| source: | APNIC |

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# Mnt-by & mnt-lower

- ‘mnt-by’ attribute
  - Can be used to protect any object
  - Changes to protected object must satisfy authentication rules of ‘mntner’ object.
- ‘mnt-lower’ attribute
  - Also references mntner object
  - Hierarchical authorisation for inetnum & domain objects
  - The creation of child objects must satisfy this mntner
  - Protects against unauthorised updates to an allocated range - highly recommended!

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# Authentication/Authorisation

- APNIC allocation to member
  - Created and maintained by APNIC

IP

```
Inetnum:     203.146.96.0 - 203.146.127.255
netname:     LOXINFO-TH
descr:       Loxley Information Company Ltd.

Descr:       304 Suapah Rd, Promprab,Bangkok

country:     TH
admin-c:     KS32-AP
tech-c:      CT2-AP
mnt-by:      APNIC-HM
mnt-lower:   MAINT-TH-LOXINFO
changed:     hostmaster@apnic.net 19990714
Status:      ALLOCATED PORTABLE
source:      APNIC
```

1. Only APNIC can change this object
2. Only Loxinfo can create assignments within this allocation

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# Authentication/Authorisation

– Member assignment to customer
  • Created and maintained by APNIC member

IP

```
Inetnum:     203.146.113.64 - 203.146.113.127
netname:     SCC-TH
descr:       Sukhothai Commercial College
Country:     TH
admin-c:     SI10-AP
tech-c:      VP5-AP
mnt-by:      MAINT-TH-LOXINFO
changed:     voraluck@loxinfo.co.th 19990930
Status:      ASSIGNED NON-PORTABLE
source:      APNIC
```

Only LOXINFO-IS can change this object

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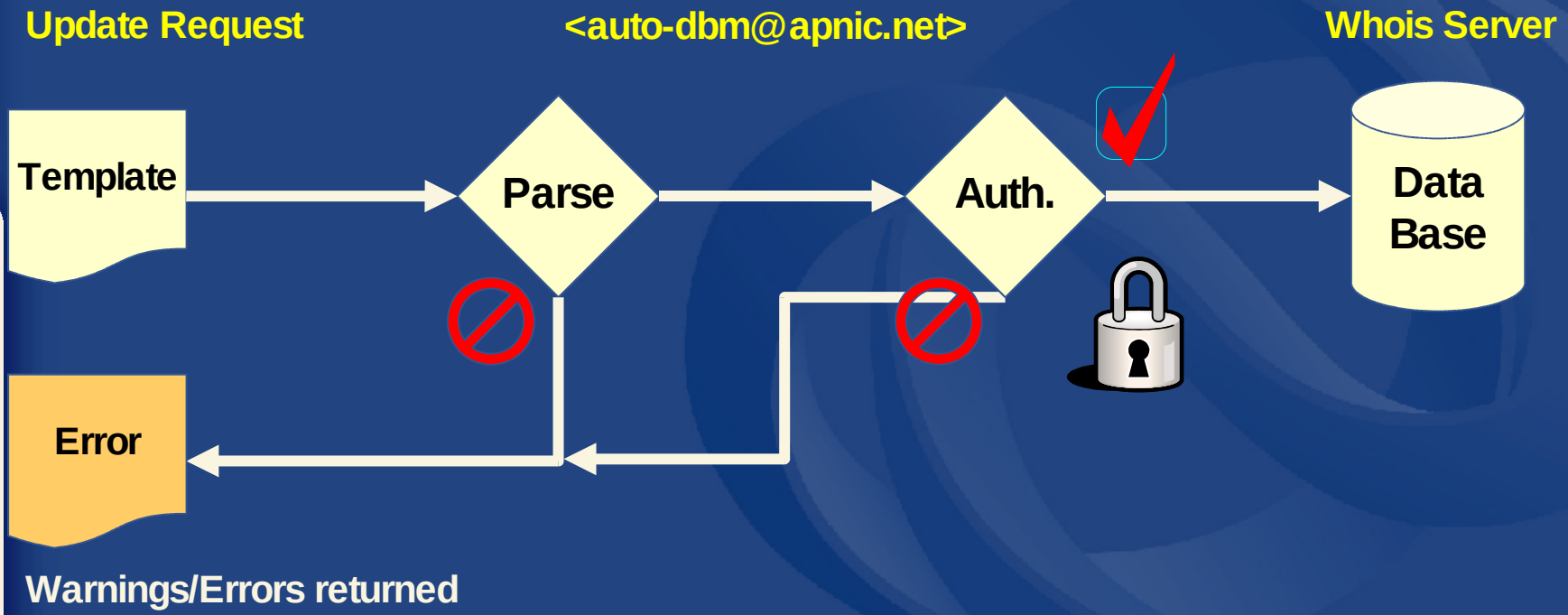
# Database update process

- Email requests to <auto-dbm@apnic.net>
- Each request contains an object template

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# Deleting an object

- Copy object as-is in database into email
- Add your maintainer password
- Leave the changed attribute

```
inetnum:        202.182.224.0 - 202.182.225.255
netname:        SONY-HK
...
mnt-by:         MAINT-CNS-AP
changed:        ph@macroview.com 19990617
source:         APNIC
password:       x34zky
delete:         no longer required me@company.com
```

Note: Referenced objects cannot be deleted (02/99)

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# Forgotten the password?

- If you are an APNIC member
  - Are you an APNIC's authorised contact?
  - If yes,
    - send a request for password reset to helpdesk@apnic.net
  - If no,
    - become an authorised contact first
    - http://www.apnic.net/info/faq/isp-request-tips.html#2
- If you are not an APNIC member and holding legacy space
  - Send your request for password reset to helpdesk@apnic.net
    - Go through necessary procedures to confirm your custodianship before resetting password

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# Checkpoint

*What is the difference between mnt-by and mnt-lower?*

- mnt-by protects the object itself.
- mnt-lower prevents the unauthorised creation of child/sub-objects.

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# Questions ?



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# Requesting Internet Resources

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# Overview of allocation and registration process

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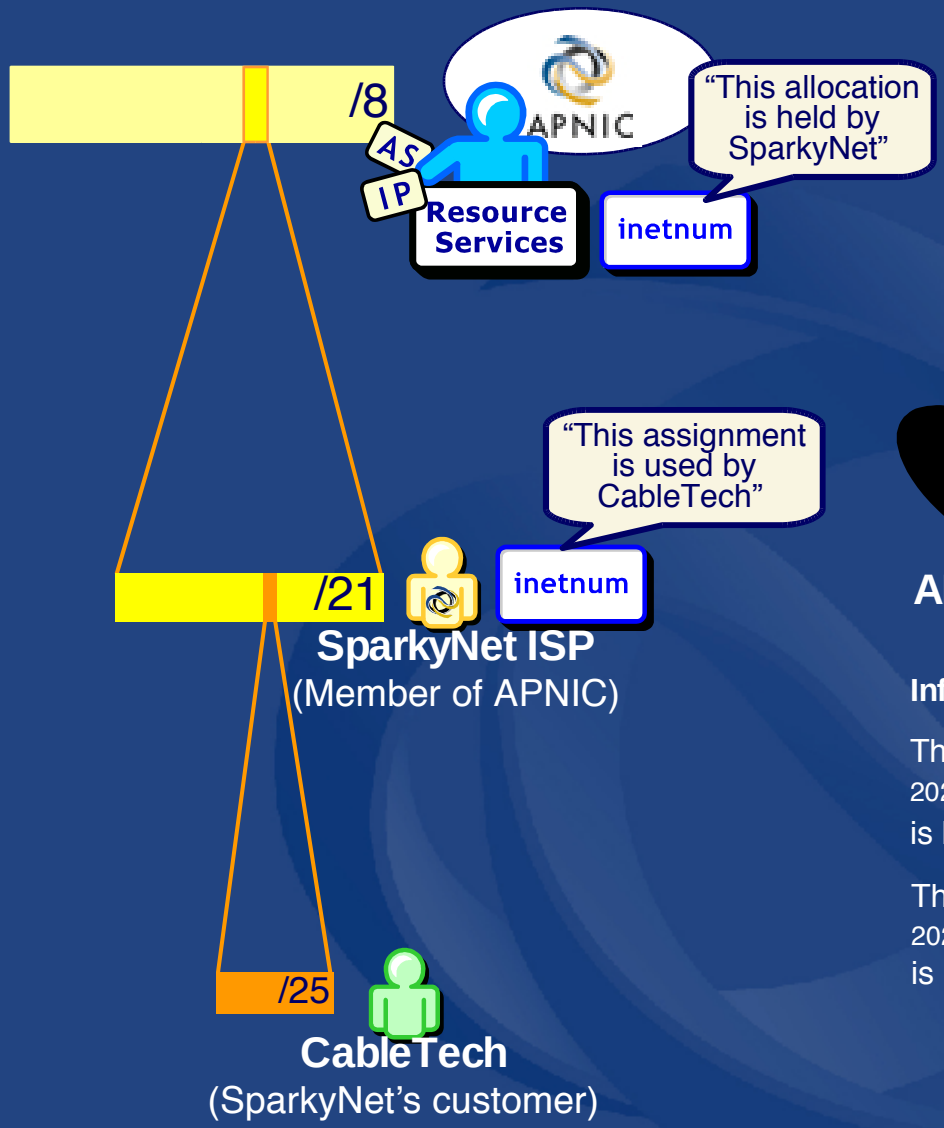
## APNIC:

- selects range to allocate to member
- registers allocation in DB
- allocates the addresses to member

## Member:

- selects range to assign to customer
- registers assignment in DB
- assigns the addresses to customer




**Information in Database:**

The allocation
202.12.0.0– 202.12.7.255
is held by SparkyNet

The assignment
202.12.1.0 – 202.12.1.127
is used by CableTech

# IP address request process

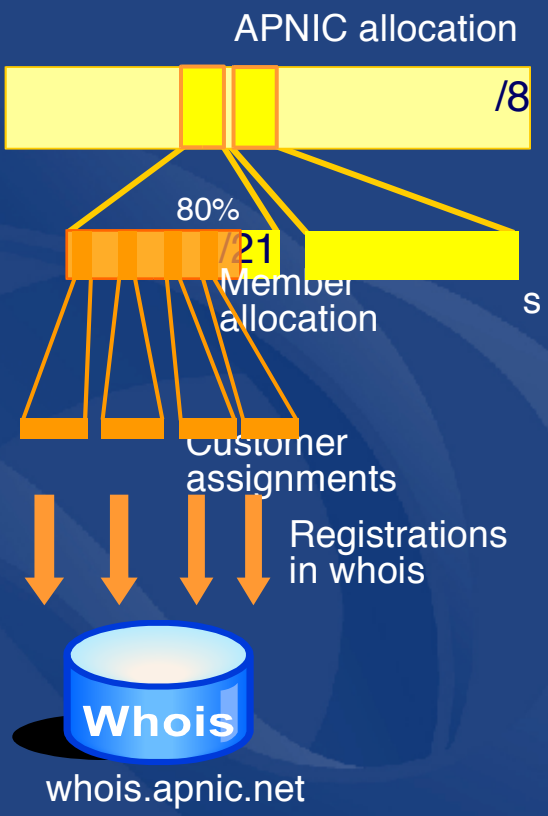
Submit allocation request → *Using the "ISP request form"* → *APNIC will allocate you a /21 (2048 addr)**

Submit 2nd opinion requests for your customer assignments → *All customer assignments and sub-allocations out of your address block should follow the 2nd opinion process*

Register all customer assignments in the whois DB → *All customer assignments & sub-allocations should be in the APNIC whois Database*

80% utilisation → *When 80% is used, you qualify for an additional allocation*

Submit new allocation request → *Using the "ISP request form"* → *Next allocation size based on prev utilisation*

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# Request forms & documentation

- Allocation Request
  - "ISP Address Request Form"
    - http://www.apnic.net/services/ipv4/
- Assignment Request
  - "Second opinion Request Form"
    - http://cgi.apnic.net/apnic-bin/second-opinion-request.pl
- Other relevant documents:
  - IPv4 guide
    - http://www.apnic.net/services/ipv4_guide.html
  - IPv4 policy document
    - http://www.apnic.net/docs/policy/add-manage-policy.html
  - Quick tips
    - http://www.apnic.net/info/faq/isp-request-tips.html


# Hostmaster Administrivia

- <hostmaster@apnic.net> mailbox
  - Is filtered to accept requests from members only
  - Requires member account name
    - Subject: IP Address Request [CONNECT-AU]
- Ticketing system
  - Every request is assigned a ticket
    - Ticket # is a confirmation that your request has been well received
- New staff at LIR
  - Require an ‘introduction’ to hostmasters
  - To ensure confidentiality

# Requesting IP addresses

- Provide a detailed description of your network topology
  - More information provided = less iteration
- Make sure the request has correct format & syntax
    - http://www.apnic.net/services/help/isp_txt/
    - http://ftp.apnic.net/apnic/docs/second-opinion-request
- Provide list of all current addresses held
- Additional comments field
  - Topology map, deployment plan etc
    - Any additional info that supports the request
- Plan to adopt best current practice

# Requesting new allocation - Checklist

Utilisation in allocation is 80%

All customer assignments are registered in the whois database

- With accurate and up-to-data information

Sufficient documentation to support address requirement

Membership fee is paid

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# Member Services Helpdesk

- One point of contact for all member enquiries

## Helpdesk hours

9:00 am - 7:00 pm (AU EST, UTC + 10 hrs)

**ph: +61 7 3858 3188** **fax: 61 7 3858 3199**


- *More personalised service*
  - Range of languages:
    Cantonese, Filipino, Mandarin, Hindi, Vietnamese etc.
- *Faster response and resolution of queries*
  - IP resource applications, status of requests, obtaining help in completing application forms, membership enquiries, billing issues & database enquiries

# Checkpoint

*The ISP request form is used for requesting an allocation from APNIC… but what is an allocation?*

A block of address space held by an IR (or downstream ISP) for subsequent allocation or assignment

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# Questions ?



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# Reverse DNS Delegation

## Registry Procedures

# What is ‘Reverse DNS’?

- ‘Forward DNS’ maps names to numbers
  - svc00.apnic.net -> 202.12.28.131
- ‘Reverse DNS’ maps numbers to names
  - 202.12.28.131 -> svc00.apnic.net

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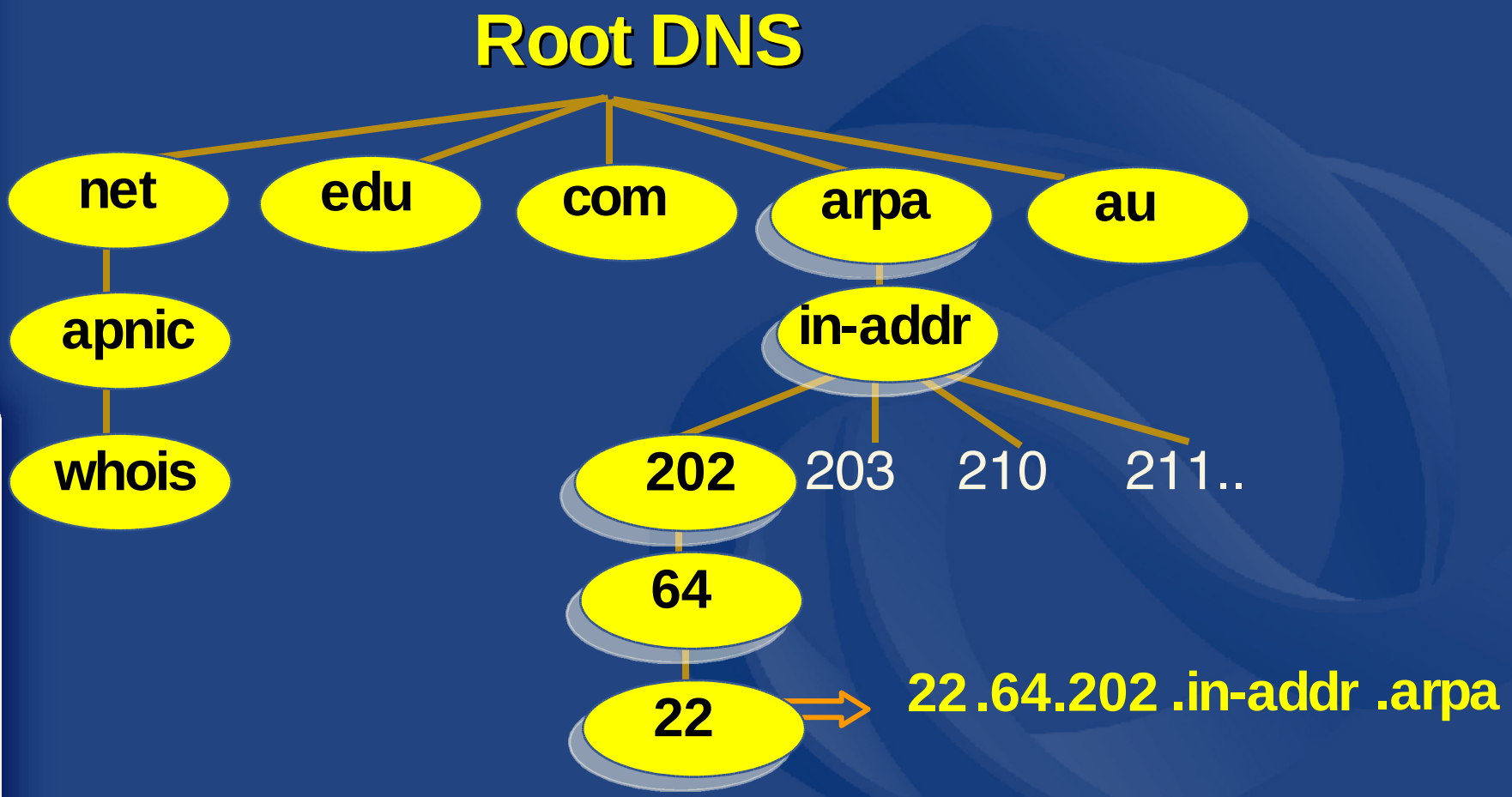
# Reverse DNS delegation

*- Mapping numbers to names - 'reverse DNS'*

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# Reverse DNS - why bother?

- Service denial
  - That only allow access when fully reverse delegated eg. anonymous ftp
- Diagnostics
  - Assisting in trace routes etc
- Registration
  - Responsibility as a member and Local IR

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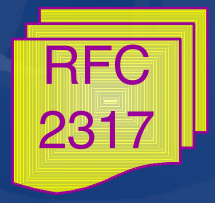
# Reverse delegation requirements

- /24 Delegations
  - Address blocks should be assigned/allocated
  - At least two name servers
- /16 Delegations
  - Same as /24 delegations
  - APNIC delegates entire zone to member
  - Recommend APNIC secondary zone
- < /24 Delegations
  - Read “classless in-addr.arpa delegation”

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# Delegation procedures

- Upon allocation, member is asked if they want /24 place holder domain objects with member maintainer
  - Gives member direct control
- Standard APNIC database object,
  - can be updated through online form or via email.


- Nameserver/domain set up verified before being submitted to the database.
- Protection by maintainer object
  - (current auths: NONE, CRYPT-PW, PGP).

- Zone file updated 2-hourly

# Example ‘domain’ object

DNS

| | |
|---|---|
| domain: | 124.54.202.in-addr.arpa |
| descr: | co-located server at mumbai |
| country: | IN |
| admin-c: | VT43-AP |
| tech-c: | IA15-AP |
| zone-c: | IA15-AP |
| nserver: | dns.vsnl.net.in |
| nserver: | giasbm01.vsnl.net.in |
| mnt-by: | MAINT-IN-VSNL |
| changed: | gpsingh@vsnl.net.in 20010612 |
| source: | APNIC |

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# Delegation procedures – request form

- Complete the documentation
  - http://www.apnic.net/db/domain.html
- On-line form interface
  - Real time feedback
  - Gives errors, warnings in zone configuration
    - serial number of zone consistent across nameservers
    - nameservers listed in zone consistent
  - Uses database ‘domain’ object
    - examples of form to follow..

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DNS

# Questions?

- Are all your zones, and your customer zones registered?



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# Checkpoint

*Why is reverse DNS important?*

Failing to set up reverse DNS can lead to service denials, lack of useful diagnostics (e.g. traceroute), problems with identifying sources of spam/abuse.

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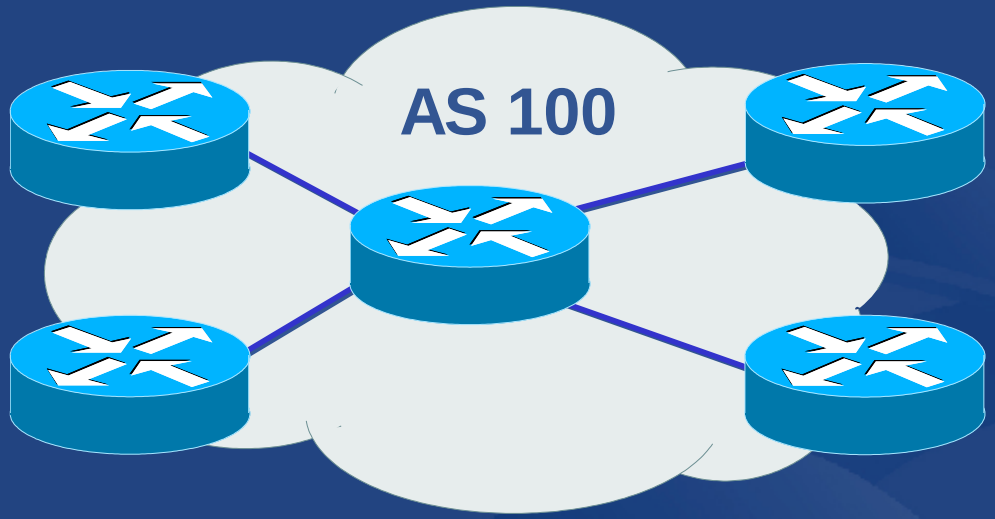
# Autonomous System Numbers

## Procedures

# What is an Autonomous System?




- Collection of networks with same routing policy
- Usually under single ownership, trust and administrative control

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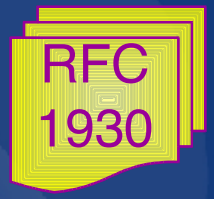
# When do I need an ASN?

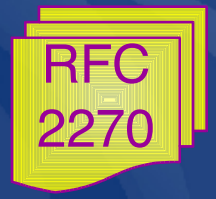
- When do I need an AS?
  - Multi-homed network to different providers and
  - Routing policy different to external peers




- Recommended reading!
  - RFC1930: Guidelines for creation, selection and registration of an Autonomous System

# When don't I need an ASN?

- Factors that don't count
  - Transition and 'future proofing'
  - Multi-homing to the same upstream
    - RFC2270: A dedicated AS for sites homed to a single provider
  - Service differentiation
    - RFC1997: BGP Communities attribute





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# Requesting an ASN

- Complete the request form
  - web form available:
    - http://www.apnic.net/db/aut-num.html
- Request form is parsed - real time
  - Must include routing policy
    - multiple import and export lines
  - Is checked for syntactical accuracy
    - based on RPSL (rfc2622)
  - Peers verified by querying routing table
  - [NO-PARSE] will not send request to parser

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# Requesting an ASN - Customers

1. Requested directly from APNIC
   - AS number is “portable”
2. Requested via member
   - ASN is “non-portable”
   - ASN returned if customer changes provider

- Transfers of ASNs
  - Need legal documentation (mergers etc)
  - Should be returned if no longer required

# Aut-num object example

AS

```
aut-num:        AS4777
as-name:        APNIC-NSPIXP2-AS
descr:          Asia Pacific Network Information Centre
descr:          AS for NSPIXP2, remote facilities site
import:         from AS2500 action pref=100; accept ANY
import:         rom AS2524 action pref=100; accept ANY
import:         from AS2514 action pref=100; accept ANY
export:         to AS2500 announce AS4777
export:         to AS2524 announce AS4777
export:         to AS2514 announce AS4777
default: to AS2500 action pref=100; networks ANY
admin-c:        PW35-AP
tech-c:         NO4-AP
remarks:        Filtering prefixes longer than /24
mnt-by:         MAINT-APNIC-AP
changed:        paulg@apnic.net 19981028
source:         APNIC
```

POLICY RPSL

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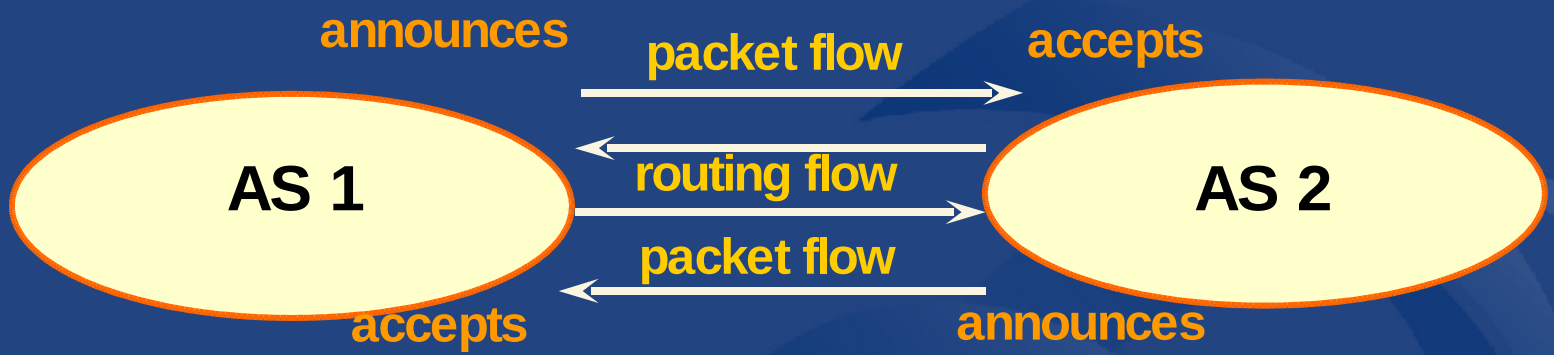
# Representation of routing policy

- Routing and packet flows




For AS1 and AS2 networks to communicate

- AS1 must announce to AS2
- AS2 must accept from AS1
- AS2 must announce to AS1
- AS1 must accept from AS2

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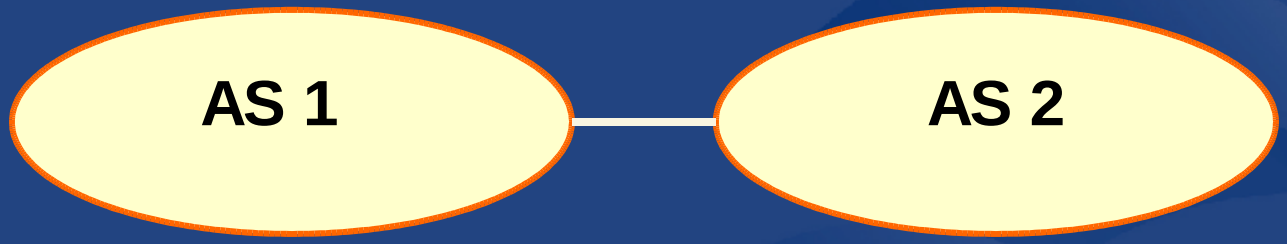
# Representation of routing policy

Basic concept

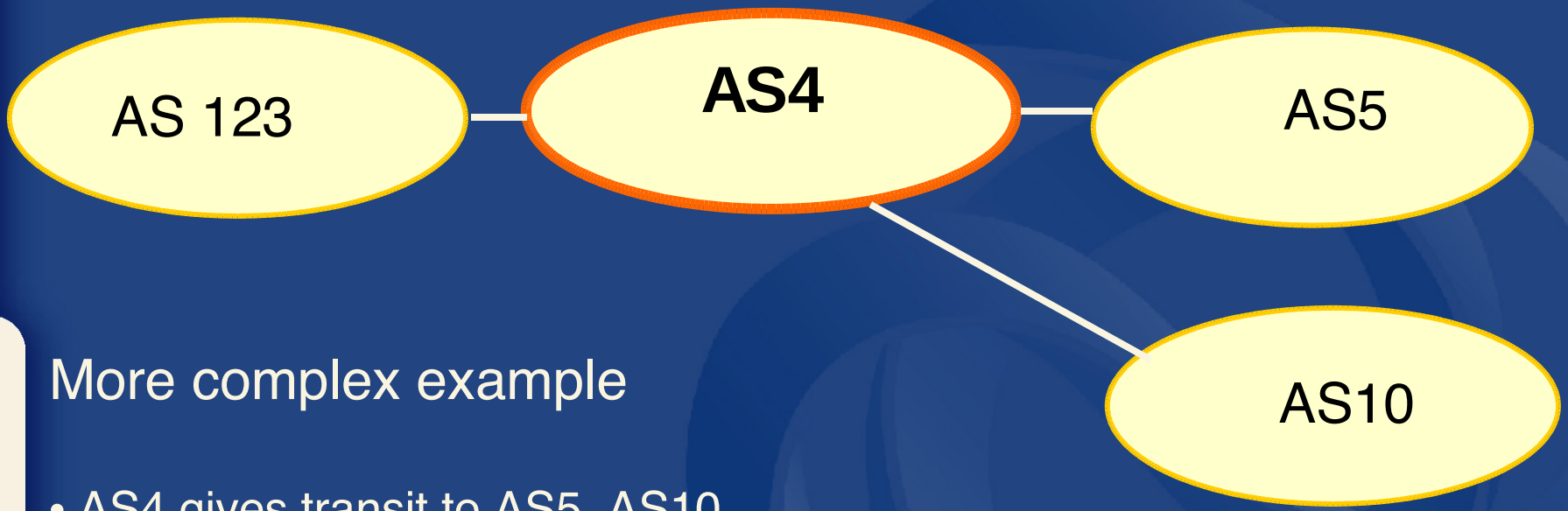



*"action pref" - the lower the value, the preferred the route*

```
aut-num: AS1
…
import:   from AS2
          action pref=100;
          accept AS2
export:   to AS2 announce AS1
```

```
aut-num: AS2
…
import:   from AS1
          action pref=100;
          accept AS1
export:   to AS1 announce AS2
```

# Representation of routing policy




More complex example

- AS4 gives transit to AS5, AS10
- AS4 gives local routes to AS123

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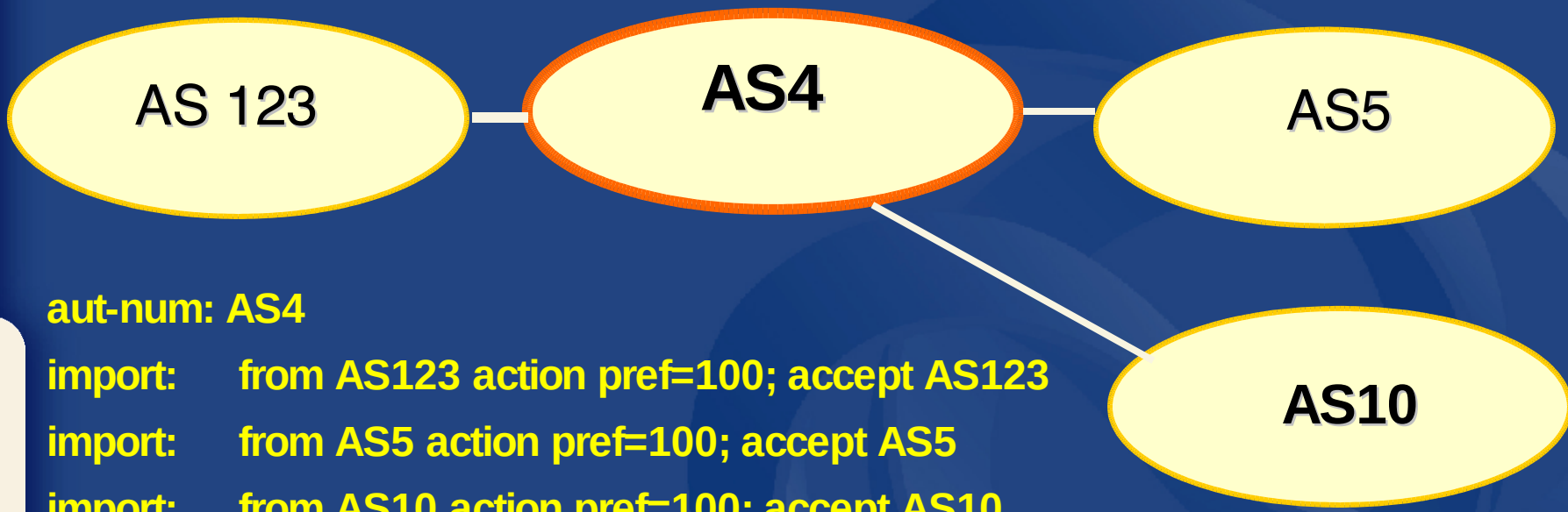
# Representation of routing policy




```
aut-num: AS4
import:    from AS123 action pref=100; accept AS123
import:    from AS5 action pref=100; accept AS5
import:    from AS10 action pref=100; accept AS10
export:    to AS123  announce  AS4
export:    to AS5 announce AS4 AS10
export:    to AS10 announce AS4 AS5
```

*Not a path*

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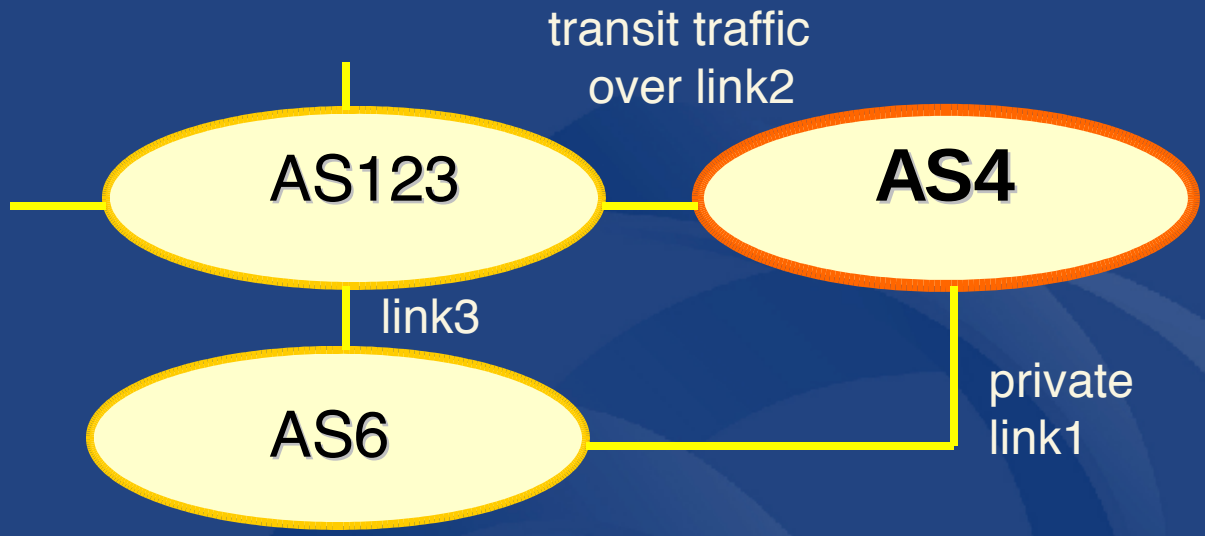
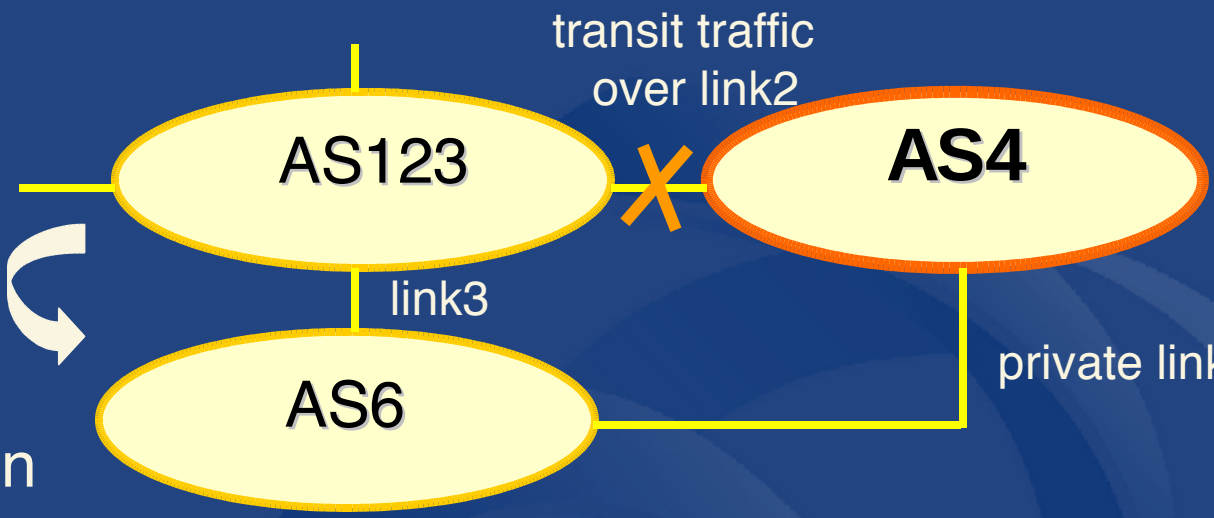
# Representation of routing policy




More complex example

- AS4 and AS6 private link1
- AS4 and AS123 main transit link2
- backup all traffic over link1 and link3 in event of link2 failure

# Representation of routing policy




AS representation

```
aut-num:    AS4
import:     from AS123 action pref=100; accept  ANY
import:     from AS6   action pref=50; accept AS6
import:     from AS6   action pref=200; accept  ANY
export:     to   AS6   announce   AS4
export:     to   AS123 announce   AS4
```

*full routing received*

*higher cost for backup route*

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# Checkpoint

*When do I need an AS number?*

An AS number is used when multihoming to two different providers and when you have a unique routing policy

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# Questions ?



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# IPv6

Technical overview

Policies & Procedures

# IPv6 Rationale

- Address depletion concerns
  - Squeeze on available addresses space
    - Probably will never run out, but will be harder to obtain
  - End to end connectivity no longer visible (NAT)

  IPv6 provides much larger IP address space than IPv4

- Increase of backbone routing table size
  - Current backbone routing table size > 100K
    - The lack of uniformity of the current hierarchical system
    - Routing aggregation is still a concern in IPv6

  IPv6 address architecture is more hierarchical than IPv4

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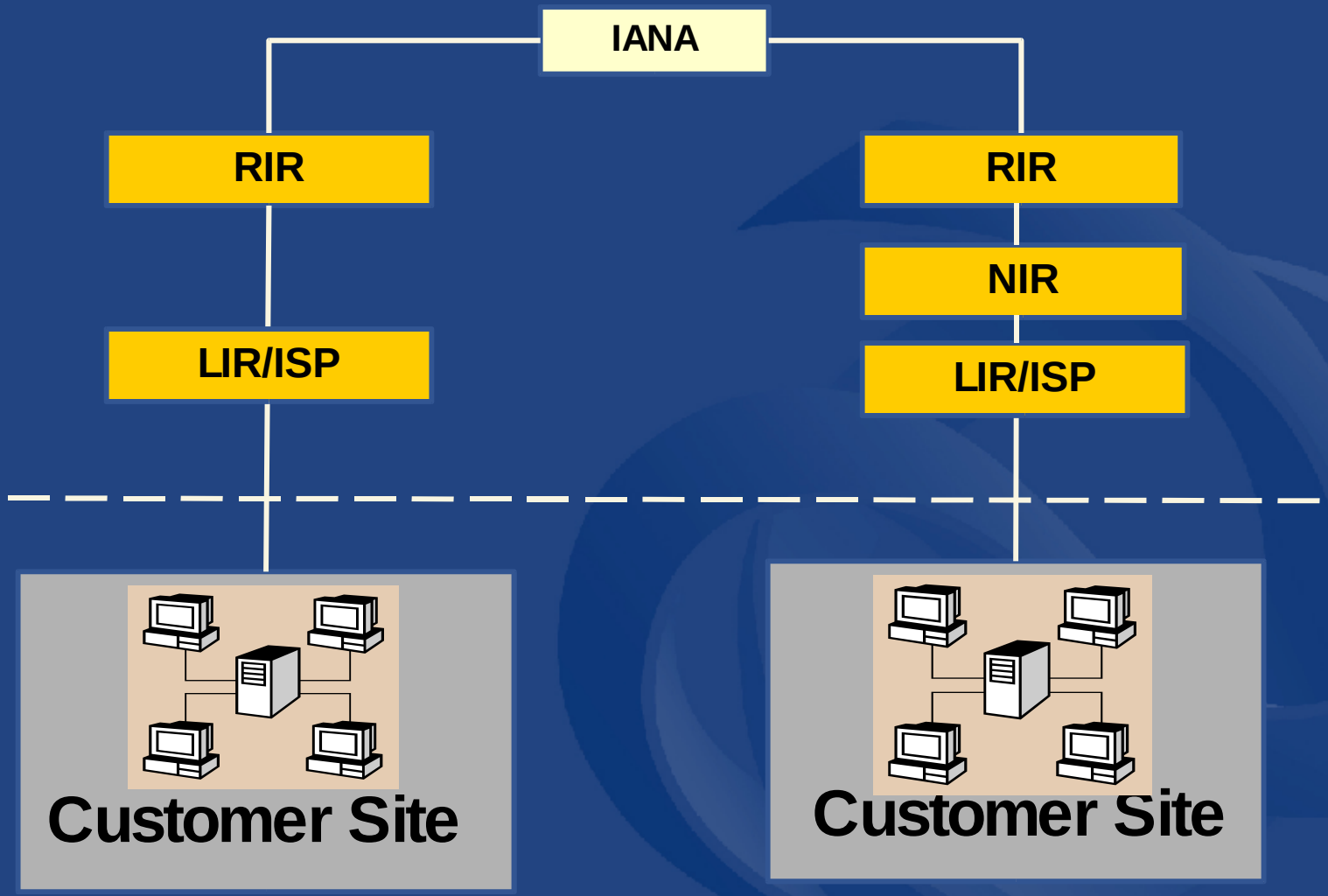
# Rationale (Cont.)

- Needs to improve the Internet environment
  - Encryption, authentication, and data integrity safeguards needed
    - Necessity of IP level security
  - Plug and Play function needed
    - Reduce network administrators work load
    - Reduce errors caused by individual users

  - More recent technologies (security, Plug and Play, multicast, etc.) available by default in IPv6

- Useful reading:
  - "The case for IPv6": http://www.6bone.net/misc/case-for-ipv6.html

# IPv6 address management hierarchy

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# IPv6 addressing

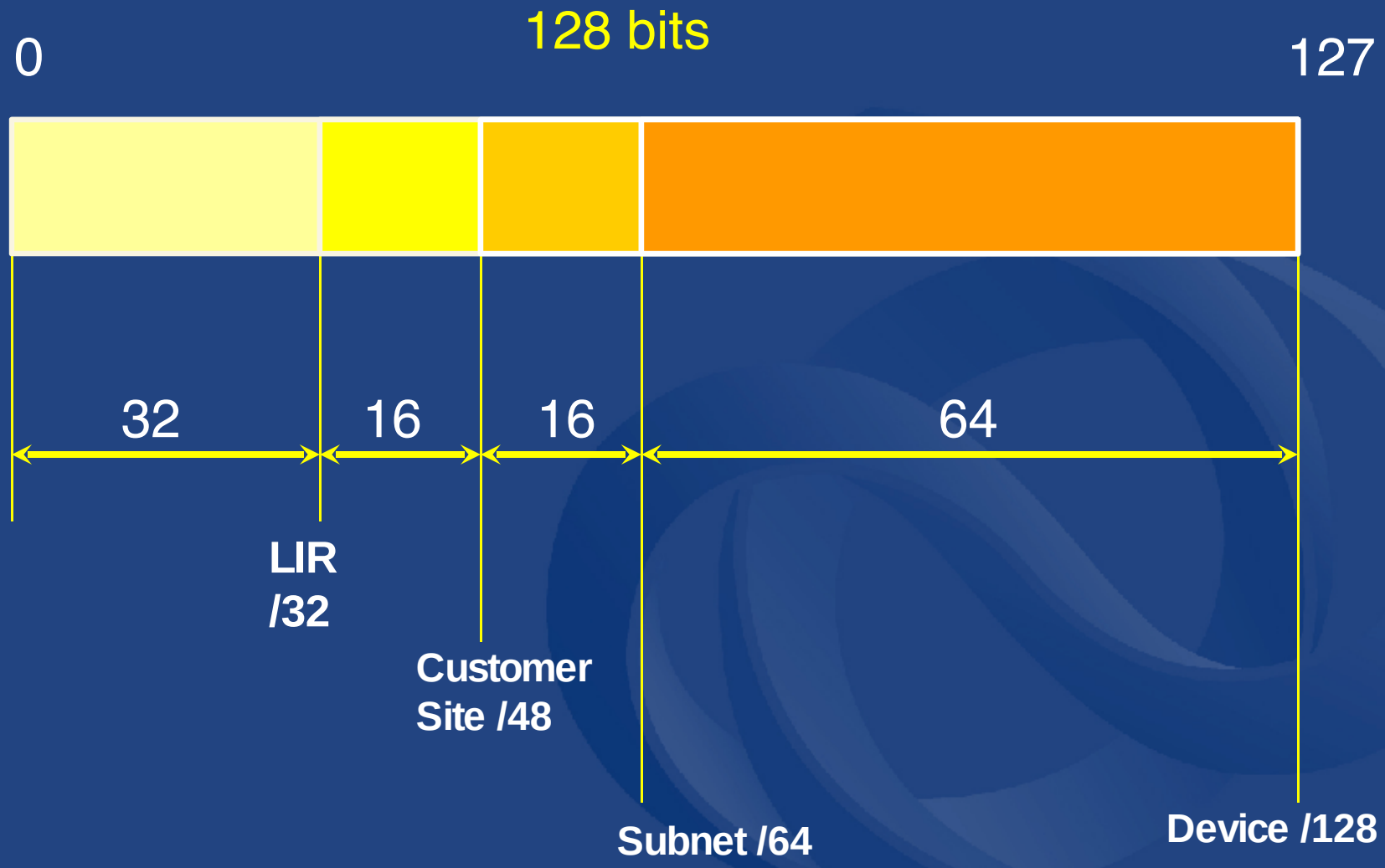
- 128 bits of address space
- Hexadecimal values of eight 16 bit fields
  - X:X:X:X:X:X:X:X (X=16 bit number, ex: A2FE)
  - 16 bit number is converted to a 4 digit hexadecimal number
- Example:
  - FE38:DCE3:124C:C1A2:BA03:6735:EF1C:683D
  - Abbreviated form of address
    - 4EED:0023:0000:0000:0000:036E:1250:2B00

    →4EED:23:0:0:0:36E:1250:2B00

    →4EED:23::36E:1250:2B00

    (Null value can be used only once)

# IPv6 addressing structure

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# IPv6 address policy goals

## Efficient address usage

- Avoid wasteful practices

## Aggregation

- Hierarchical distribution
- Limit routing table growth

## Registration

- Ensure uniqueness
- Facilitate troubleshooting

## Minimise overhead

- Associated with obtaining address space

Uniqueness, fairness and consistency

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# IPv6 initial allocation

- Initial allocation criteria
  - Plan to connect 200 end sites within 2 years
    - Default allocation (“slow start”)
- Initial allocation size is /32
  - Provides 16 bits of site address space


  - Larger initial allocations can be made if justified according to:
    - IPv6 network infrastructure plan
    - Existing IPv4 infrastructure and customer base

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# IXP IPv6 assignment policy

- Criteria
  - Demonstrate ‘open peering policy’
  - 3 or more peers
- Portable assignment size: /48
  - All other needs should be met through normal processes
  - /64 holders can “upgrade” to /48
    - Through NIRs/ APNIC
    - Need to return /64

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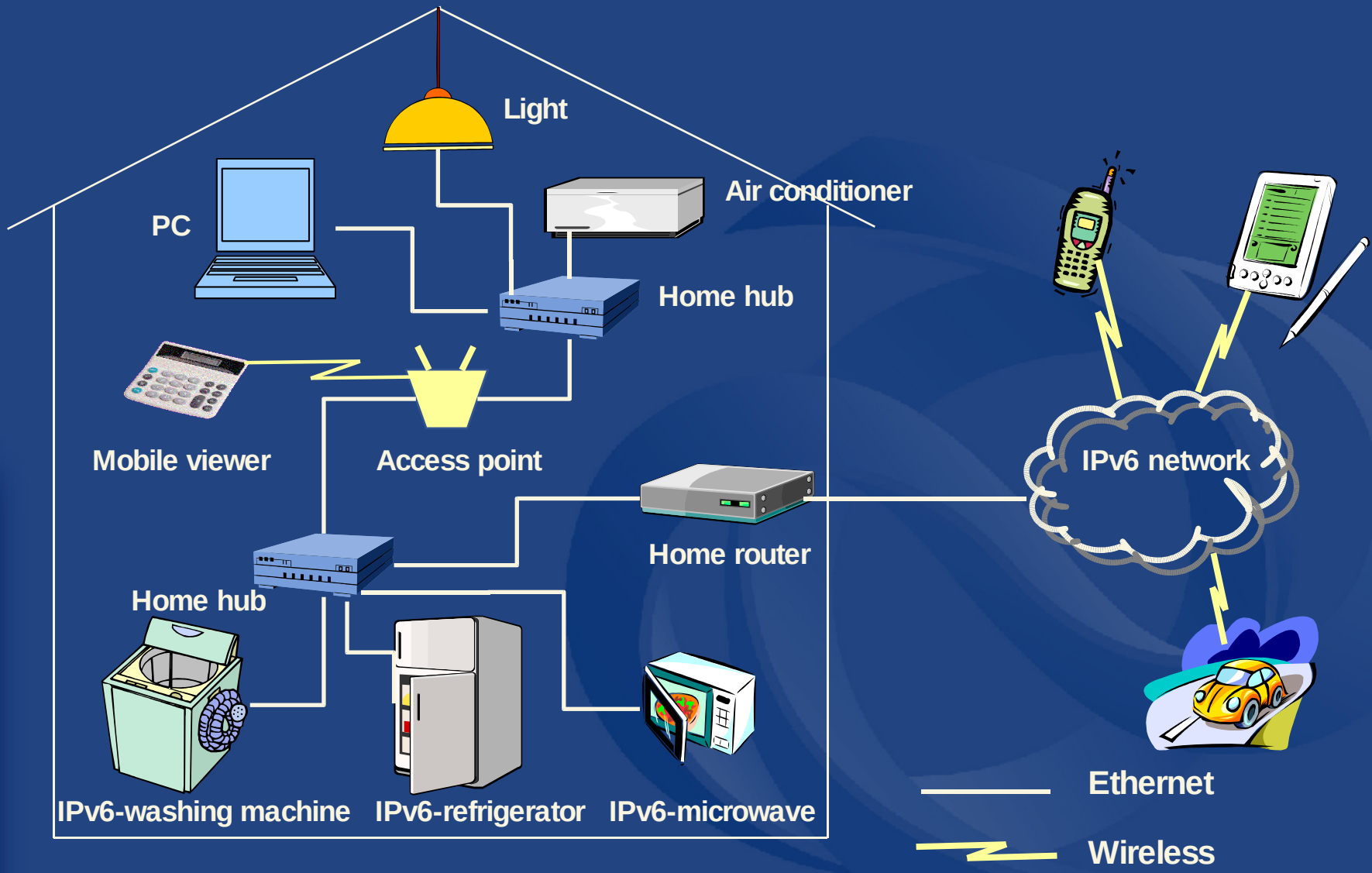
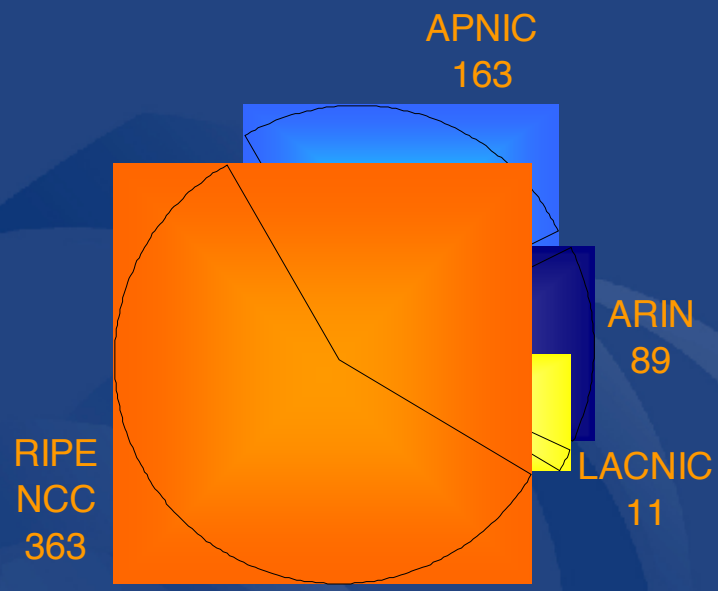
# Current IPv6 experiments



# IPv6 address allocations

- IPv6 Allocations to RIRs from IANA
  - APNIC 2001:0200::/23
    2001:0C00::/23
    2001:0E00::/23
    2001:4400::/23
  - ARIN 2001:0400::/23
    2001:1800::/23
  - LACNIC 2001:1200::/23
  - RIPE NCC 2001:0600::/23
    2001:0800::/23
    2001:0A00::/23
    2001:1400::/23
    2001:1600::/23
    2001:1A00::/23




IPv6 address request form http://ftp.apnic.net/apnic/docs/ipv6-alloc-request
IPv6 FAQ http://www.apnic.net/faq/IPv6-FAQ.html

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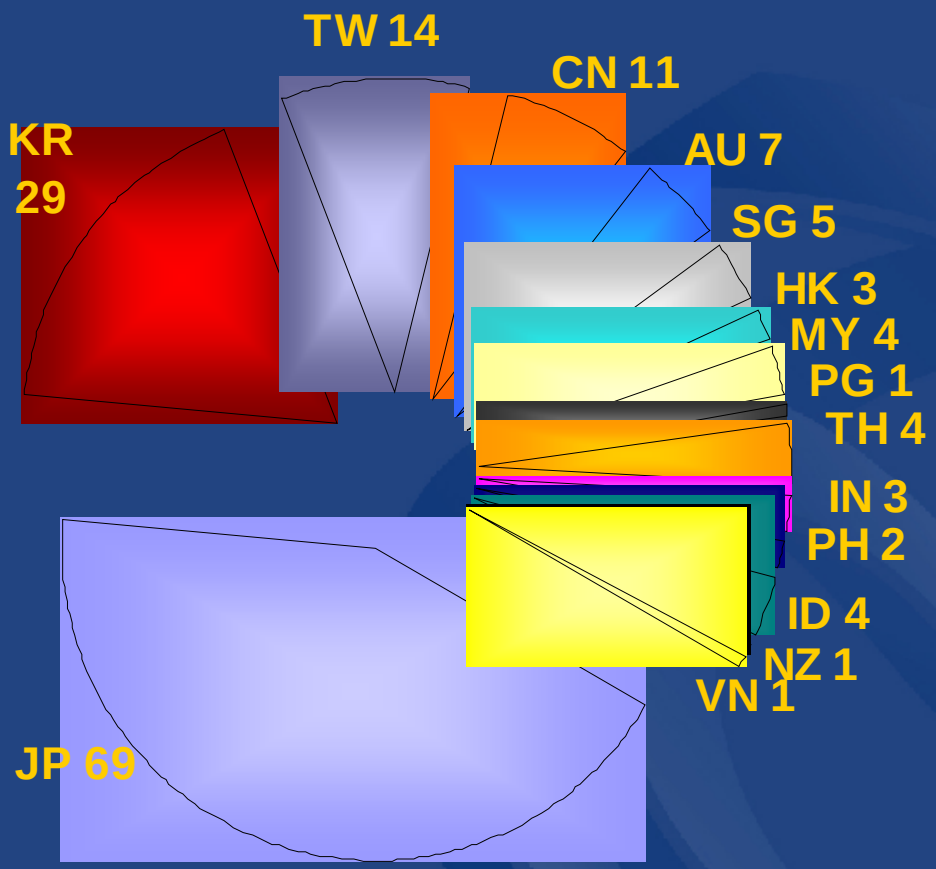
# IPv6 allocations in Asia Pacific




Total: 163

July 2004

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# Checkpoint

*What was the main problem they were trying to solve by creating IPv6?*

Squeeze on available IPv4 address space. The amount of addresses available is the main difference between v4 and v6.

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# Questions ?



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# Summary

What we have covered today

# Summary

- APNIC role in the Asia Pacific
- Internet Registry Policies
- Requesting an IP allocation
- APNIC Database
- Reverse DNS
- ASN Assignment
- IPv6 Overview

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# Summary - responsibilities

- As an APNIC member and custodian of address space
  - Be aware of your responsibilities
  - Register customer assignments in APNIC database
    - Keep this data up-to-date & accurate
  - Educate your customers
  - Document your network in detail
    - Keep local records
  - Register reverse DNS delegations

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# Summary

- "Do the right thing"
  - Think about routing table size & scalability of Internet
  - Encourage renumbering
  - Announce aggregate prefixes
  - Think global not local

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# Thank you !!

Your feedback is appreciated

*Material available at:*
http://www.apnic.net/training/recent/

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# Supplementary Reading

# Training material

- Today's training material will be made available at:

http://www.apnic.net/training/recent/

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# Introduction

## Regional Registry web sites

- APNIC:
  http://www.apnic.net
- ARIN:
  http://www.arin.net
- LACNIC:
  http://www.lacnic.net
- RIPE NCC:
  http://www.ripe.net

## APNIC past meetings

http://www.apnic.net/meetings

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# Introduction

## APNIC members

http://www.apnic.net/members.html

## Membership

- Membership procedure

  http://www.apnic.net/membersteps.html
- Membership application form

  http://www.apnic.net/apnic-bin/membership-application.pl
- Membership fees

  http://www.apnic.net/docs/corpdocs/FeeSchedule.htm

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# Introduction to APNIC & IP Policy

## Classless techniques

- CIDR
  http://www.ietf.org/rfc/rfc1517-19.txt
- Network Addressing when using CIDR
  ftp://ftp.uninett.no/pub/misc/eidnes-cidr.ps.Z
- Variable Length Subnet Table
  http://www.ietf.org/rfc/rfc1878.txt

## Private Address Space

- Address Allocation for Private Internets
  http://www.ietf.org/rfc/rfc1918.txt
- Counter argument: “Unique addresses are good”
  http://www.ietf.org/rfc/rfc1814.txt

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# Bit boundary chart

| addrs | bits | pref | class | mask |
|---|---|---|---|---|
| 1 | 0 | /32 | | 255.255.255.255 |
| 2 | 1 | /31 | | 255.255.255.254 |
| 4 | 2 | /30 | | 255.255.255.252 |
| 8 | 3 | /29 | | 255.255.255.248 |
| 16 | 4 | /28 | | 255.255.255.240 |
| 32 | 5 | /27 | | 255.255.255.224 |
| 64 | 6 | /26 | | 255.255.255.192 |
| 128 | 7 | /25 | | 255.255.255.128 |
| 256 | 8 | /24 | 1C | 255.255.255 |
| 512 | 9 | /23 | 2C | 255.255.254 |
| 1,024 | 10 | /22 | 4C | 255.255.252 |
| 2,048 | 11 | /21 | 8C | 255.255.248 |
| 4,096 | 12 | /20 | 16C | 255.255.240 |
| 8,192 | 13 | /19 | 32C | 255.255.224 |
| 16,384 | 14 | /18 | 64C | 255.255.192 |
| 32,768 | 15 | /17 | 128C | 255.255.128 |
| 65,536 | 16 | /16 | 1B | 255.255 |
| 131,072 | 17 | /15 | 2B | 255.254 |
| 262,144 | 18 | /14 | 4B | 255.252 |
| 524,288 | 19 | /13 | 8B | 255.248 |
| 1,048,576 | 20 | /12 | 16B | 255.240 |
| 2,097,152 | 21 | /11 | 32B | 255.224 |
| 4,194,204 | 22 | /10 | 64B | 255.192 |
| 8,388,608 | 23 | /9 | 128B | 255.128 |
| 16,777,216 | 24 | /8 | 1A | 255 |
| 33,554,432 | 25 | /7 | 2A | 254 |
| 67,108,864 | 26 | /6 | 4A | 252 |
| 134,217,728 | 27 | /5 | 8A | 248 |
| 268,435,456 | 28 | /4 | 16A | 240 |
| 536,870,912 | 29 | /3 | 32A | 224 |
| 1,073,741,824 | 30 | /2 | 64A | 192 |

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# APNIC Mailing Lists

- apnic-talk
  - Open discussions relevant to APNIC community & members
- apnic-announce
  - Announcements of interest to the AP community
- sig-policy
  - IPv4 and IPv6 allocation and assignment policies
- global-v6
  - Global IPv6 policy mailing list

- subscribe via <majordomo@apnic.net>
- archives:

  http://ftp.apnic.net/apnic/mailing-lists

http://www.apnic.net/net_comm/lists/

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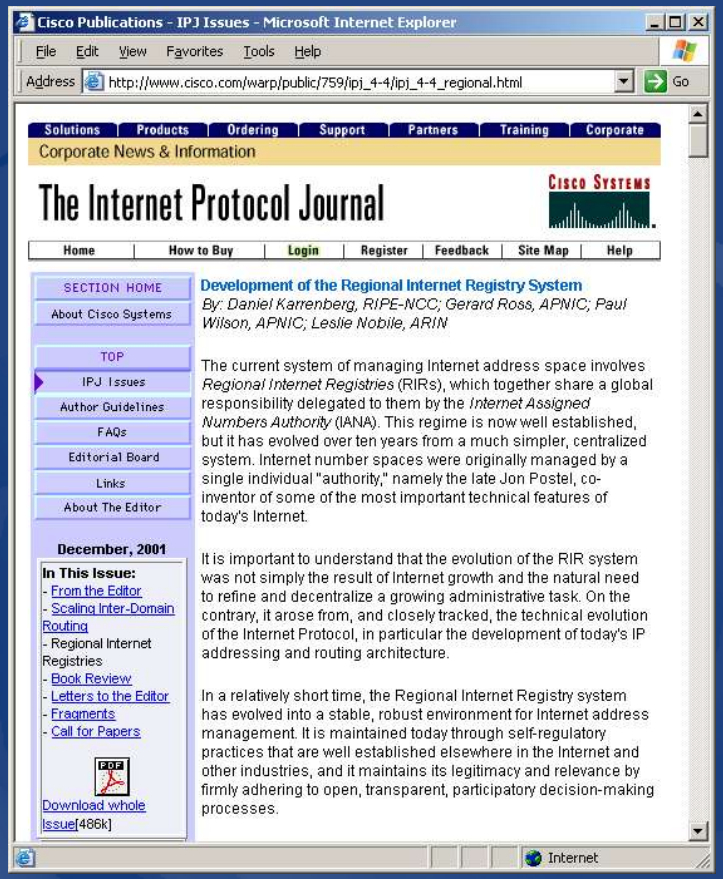
# The RIR System

*"Development of the Regional Internet Registry System"*

Internet Protocol Journal

Vol. 4, Number 4

Short history of the Internet




http://www.cisco.com/warp/public/759/ipj_4-4/ipj_4-4_regional.html

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# Policies & Policy Environment

## Policy Documentation

- Policies for address space management in the Asia Pacific region

  http://www.apnic.net/docs/policy/add-manage-policy.html

- RFC2050: Internet Registry IP allocation Guidelines

  http://www.ietf.org/rfc/rfc2050.txt

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# Address Request Procedures

## Addressing Guidelines

- "Designing Addressing Architectures for Routing & Switching", Howard C. Berkowitz

## Address Request Forms

- ISP Address Request Form

  http://www.apnic.net/services/ipv4/

- Second-opinion Request Form

  http://www.apnic.net/services/second-opinion/

- No Questions Asked

  http://ftp.apnic.net/apnic/docs/no-questions-policy

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# APNIC Database

## APNIC Database Documentation

- Updating information in the APNIC Database
  http://ftp.apnic.net/apnic/docs/database-update-info
- Maintainer & Person Object Request Form
  http://ftp.apnic.net/apnic/docs/mntner-person-request
- APNIC Maintainer Object Request
  http://www.apnic.net/apnic-bin/maintainer.pl
- APNIC Whois Database objects resource guide
  http://www.apnic.net/services/whois_guide.html

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# APNIC Database

## RIPE Database Documentation

- RIPE Database Reference Manual

  http://www.ripe.net/docs/databaseref-manual.html

## Database 'whois' Client

http://ftp.apnic.net/apnic/dbase/tools/ripe-dbase-client.tar.gz

## Database web query

http://www.apnic.net/apnic-bin/whois2.pl

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# Reverse DNS

## Request Forms

- Guide to reverse zones

  http://www.apnic.net/db/revdel.html

- Registering your Rev Delegations with APNIC

  http://www.apnic.net/db/domain.html

## Relevant RFCs

- Classless Delegations

  http://www.ietf.org/rfc/rfc2317.txt

- Common DNS configuration errors

  http://www.ietf.org/rfc/rfc1537.txt

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# Reverse DNS

## Documentation

- Domain name structure and delegation

  http://www.ietf.org/rfc/rfc1591.txt

- Domain administrators operations guide

  http://www.ietf.org/rfc/rfc1033.txt

- Taking care of your domain

  ftp://ftp.ripe.net/ripe/docs/ripe-114.txt

- Tools for DNS debugging

  http://www.ietf.org/rfc/rfc2317.txt

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# AS Assignment Procedures

## Policy

- Guidelines for the creation, selection, and registration of an AS

  http://www.ietf.org/rfc/rfc1930.txt

## RFCs

- Routing Policy Specification Language (RPSL)

  http://www.ietf.org/rfc/rfc2280.txt

- A dedicated AS for sites homed to a single provider

  http://www.ietf.org/rfc/rfc2270.txt

- RFC1997: BGP Communities attribute

  http://www.ietf.org/rfc/rfc2270.txt

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# IPv6

## Policy Documents

- IPv6 Address Policy

  http://ftp.apnic.net/apnic/docs/ipv6-address-policy

- IPv6 Address request form

  http://ftp.apnic.net/apnic/docs/ipv6-alloc-request

## Useful reading

- The case for IPv6

  http://www.6bone.net/misc/case-for-ipv6.html

## FAQ

http://www.apnic.net/info/faq/IPv6-FAQ.html

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# IPv6: HD Ratio 0.8

| IPv6 prefix | Site addr bits | Total site addrs in /48s | Threshold | Util% |
|---|---|---|---|---|
| **42** | 6 | 64 | 28 | **43.5%** |
| **36** | 12 | 4096 | 776 | **18.9%** |
| **35** | 13 | 8192 | 1351 | **16.5%** |
| **2** | 6 | 65536 | 7132 | **10.9%** |
| **29** | 19 | 524288 | 37641 | **7.2%** |
| **24** | 24 | 16777216 | 602249 | **.6%** |
| **16** | 2 | 294967296 | 50859008 | **1.2%** |
| | 40 | 099511627776 | 4294967296 | **0.4%** |
| **3** | 45 | 35184372088832 | 68719476736 | **0.2%** |

RFC3194 “The Host-Density Ratio for Address Assignment Efficiency”

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# Other supplementary reading

## Operational Content Books

- *ISP Survival Guide*, Geoff Huston
- *Cisco ISP Essentials*, Philip Smith

## BGP Table

http://www.telstra.net/ops/bgptable.html

http://www.merit.edu/ipma/reports

http://www.merit.edu/ipma/routing_table/mae-east/prefixlen.990212.html

http://www.employees.org/~tbates/cidr.hist.plot.html

## Routing Instability

http://zounds.merit.net/cgi-bin/do.pl

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# Other supplementary reading

## Routing & Mulithoming

- *Internet Routing Architectures* - Bassam Halabi
- BGP Communities Attribute

  http://www.ietf.org/rfc/rfc1997.txt

  http://www.ietf.org/rfc/rfc1998.txt

## Filtering

- Egress Filtering

  http://www.cisco.com/public/cons/isp

- Network Ingress Filtering: Defeating Denial of Service Attacks which employ IP Source Address Spoofing

  http://www.ietf.org/rfc/rfc2267.txt

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# Other Supplementary Reading

- Dampening case studies at
  http://www.cisco.com/warp/public/459/16.html
- Traceroute Server
  http://nitrous.digex.net
- Network Renumbering Overview: Why Would I Want It and What Is It Anyway?
  http://www.ietf.org/rfc/rfc2071.txt
- Procedures for Enterprise Renumbering
  http://www.isi.edu/div7/pier/papers.html
- NAT
  - The IP Network Address Translator
    http://www.ietf.org/rfc/rfc1631.txt

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# Person object template

```
person:   [mandatory]  [single]    [lookup key]
address:  [mandatory]  [multiple]  [ ]
country:  [optional]   [single]    [ ]
phone:    [mandatory]  [multiple]  [ ]
fax-no:   [optional]   [multiple]  [ ]
e-mail:   [mandatory]  [multiple]  [lookup key]
nic-hdl:  [mandatory]  [single]    [primary/look-up key]
remarks:  [optional]   [multiple]  [ ]
notify:   [optional]   [multiple]  [inverse key]
mnt-by:   [mandatory]  [multiple]  [inverse key]
changed:  [mandatory]  [multiple]  [ ]
source:   [mandatory]  [single]    [ ]
```

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# Role object template

```
role:     [mandatory] [single]    [lookup key]
address:  [mandatory] [multiple]  [ ]
country:  [optional]  [single]    [ ]
phone:    [mandatory] [multiple]  [ ]
fax-no:   [optional]  [multiple]  [ ]
e-mail:   [mandatory] [multiple]  [lookup key]
trouble:  [optional]  [multiple]  [ ]
admin-c:  [mandatory] [multiple]  [inverse key]
tech-c:   [mandatory] [multiple]  [inverse key]
nic-hdl:  [mandatory] [single]    [primary/look-up
   key]
remarks:  [optional]  [multiple]  [ ]
notify:   [optional]  [multiple]  [inverse key]
mnt-by:   [mandatory] [multiple]  [inverse key]
changed:  [mandatory] [multiple]  [ ]
source:   [mandatory] [single]    [ ]
```

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# Maintainer Object Template

```
mntner:      [mandatory] [single]   [primary/look-up key]
descr:       [mandatory] [multiple] [ ]
country:     [optional]  [single]   [ ]
admin-c:     [mandatory] [multiple] [inverse key]
tech-c:      [optional]  [multiple] [inverse key]
upd-to:      [mandatory] [multiple] [inverse key]
mnt-nfy:     [optional]  [multiple] [inverse key]
auth:        [mandatory] [multiple] [ ]
remarks:     [optional]  [multiple] [ ]
notify:      [optional]  [multiple] [inverse key]
mnt-by:      [mandatory] [multiple] [inverse key]
referral-by: [mandatory] [single]   [inverse key]
changed:     [mandatory] [multiple] [ ]
source:      [mandatory] [single]   [ ]
```

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# Inetnum object template

```
inetnum:    [mandatory] [single]   [primary/look-up key]
netname:    [mandatory] [single]   [lookup key]
descr:      [mandatory] [multiple] [ ]
country:    [mandatory] [multiple] [ ]
admin-c:    [mandatory] [multiple] [inverse key]
tech-c:     [mandatory] [multiple] [inverse key]
rev-srv:    [optional]  [multiple] [inverse key]
status:     [mandatory] [single]   [ ]
remarks:    [optional]  [multiple] [ ]
notify:     [optional]  [multiple] [inverse key]
mnt-by:     [mandatory] [multiple] [inverse key]
mnt-lower:  [optional]  [multiple] [inverse key]
mnt-routes:[optional]  [multiple] [inverse key]
mnt-irt:    [optional]  [multiple] [inverse key]
changed:    [mandatory] [multiple] [ ]
source:     [mandatory] [single]   [ ]
```

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# Aut-num Object Template

```
aut-num:     [mandatory] [single]    [primary/look-up key]
as-name:     [mandatory] [single]     [ ]
descr:       [mandatory] [multiple]   [ ]
country:     [optional]  [single]     [ ]
member-of:   [optional]  [multiple]   [ ]
import:      [optional]  [multiple]   [ ]
export:      [optional]  [multiple]   [ ]
default:     [optional]  [multiple]   [ ]
remarks:     [optional]  [multiple]   [ ]
admin-c:     [mandatory] [multiple]   [inverse key]
tech-c:      [mandatory] [multiple]   [inverse key]
cross-mnt:   [optional]  [multiple]   [inverse key]
cross-nfy:   [optional]  [multiple]   [inverse key]
notify:      [optional]  [multiple]   [inverse key]
mnt-lower:   [optional]  [multiple]   [inverse key]
mnt-routes:  [optional]  [multiple]   [inverse key]
mnt-by:      [mandatory] [multiple]   [inverse key]
changed:     [mandatory] [multiple]   [ ]
source:      [mandatory] [single]     [ ]
```

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# Domain object template

```
domain:     [mandatory] [single]   [primary/look-up
   key]
descr:      [mandatory] [multiple] [ ]
country:    [optional]  [single]   [ ]
admin-c:    [mandatory] [multiple] [inverse key]
tech-c:     [mandatory] [multiple] [inverse key]
zone-c:     [mandatory] [multiple] [inverse key]
nserver:    [mandatory] [multiple] [inverse key]
sub-dom:    [optional]  [multiple] [inverse key]
dom-net:    [optional]  [multiple] [ ]
remarks:    [optional]  [multiple] [ ]
notify:     [optional]  [multiple] [inverse key]
mnt-by:     [mandatory] [multiple] [inverse key]
mnt-lower:  [optional]  [multiple] [inverse key]
refer:     [optional]  [single]    [ ]
changed:    [mandatory] [multiple] [ ]
source:     [mandatory] [single]   [ ]
```

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